UNCLASSIFIED

AD NUMBER
AD381805
CLASSIFICATION CHANGES
TO: unclassified
FROM: confidential
LIMITATION CHANGES
TO: Approved for public release, distribution unlimited
FROM: Distribution: Further dissemination only as directed by Director, Naval Research Laboratory, Washington, DC 20375, 01 JUN 1967, or higher DoD authority.
AUTHORITY
NRL Code/5309 memo dtd 20 Feb 1997; NRL Code/5309 memo dtd 20 Feb 1997

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AD NUMBER

AD381805

CLASSIFICATION CHANGES

TO

confidential

FROM

secret

AUTHORITY

30 Jun 1979, DoDD 5200.10

AD- 361008

SECURITY REMARKING REQUIREMENTS

DOD 5200.1-R, DEC 78

REVIEW ON 01 JUN 87

SECURITY MARKING

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NRL Report 6568
Copy No. 5

High-Frequency Sky-Wave Radar Performance

[Unclassified Title]

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June 1, 1967

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SECRET

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CONTENTS

ABSTRACT

[Secret]

The expected performance of high-frequency radar has been examined as a function of sunspot cycle, season, and time of day, using recent ITSA techniques. The method of performance assay provides a good basis for both radar design and comparison. A particular set of radar parameters was chosen:

$$PG^2T\sigma = 137 \text{ db}$$

where

P = average power above a watt

G = antenna gain above an isotropic radiator in free space

T = predetection integration time over a second

σ = target radar area over a square meter,

and a 10-db postintegration signal-to-noise ratio is required. A 5-to-1 frequency band permits effective operation at distances from 500 to 1500 naut mi 95 percent of the time, to 1900 naut mi 80 percent of the time, and to 2000 naut mi 60 percent of the time. The sporadic E effects have been ignored, which makes long-range coverages optimistic. The better coverage long-range limit is generally set by the maximum one-hop distance. Vertical launch angles between 0 and 38 degrees are useful. Performance improvement possibilities have been examined; it is estimated that 20 to 40 db over the postulated 137 db could be achieved.

PROBLEM STATUS

This is an interim report; work on the problem is continuing.

AUTHORIZATION

NRL Problem R02-42
USAF MIPR (30-602)64-3412 dated
March 26, 1964, Rome Air Development Center

Manuscript submitted March 16, 1967

FOREWORD

This work was funded by the U.S. Air Force, Rome Air Development Center. Some of the material of this report was presented at the ARPA Meeting of 1-2 June 1966 at Boulder, Colorado and appears in the ARPA Proceedings.

Mr. George Haydon of the Institute for Telecommunications Science and Aeronomy has studied the over-the-horizon radar problem and helped with the radar applications of the prediction method. W. E. Gustafson of the Naval Electronics Laboratory and B. N. Navid of the Naval Research Laboratory have reviewed the report drafts and made useful suggestions. E. W. Ward of NRL has been responsible for methods of data interpretation and display.

HIGH-FREQUENCY SKY-WAVE RADAR PERFORMANCE
[Unclassified Title]

INTRODUCTION

Ionospheric radar performance depends heavily on equipment parameters and varies with geographic location, time of operation, frequency selection, and prevailing radio noise. Good values for "probability of detection" and "false-alarm rate" are not, as yet, realized with any precision either in design or measurement. The main reasons for this deficiency are the random components of the continuously changing ionosphere and inadequate knowledge of ambient noise levels. Given a specified quality of target illumination and description of the noise, the radar performance can be well defined; therefore, ionospheric path controls over radar performance will be the principal subject of this report, and a limited experience determined noise model will be used.

Since the upper atmosphere's ionization distribution, both cyclically and randomly, varies by day, season, 11-year, and longer periods, there is no choice but to base analysis upon the body of data that have been collected in the past. Further, it is attractive to build upon the performance-prediction techniques that have been developed for hf communication circuits. However, the conventional prediction techniques for hf circuits have been incomplete and ill-suited to the radar case, such that performance could be specified in a form little better than an intuitive estimate. Recent improvements (1) in the treatment of basic ionospheric data and the use of electronic computers to process these data have permitted improvement in high-frequency (hf) circuit prediction and have made possible a more detailed treatment of the hf radar case. The techniques described by Lucas and Haydon (2) have been applied to hf radars sited at several locations. The radar and the target have generally been assumed near the earth surface. The required frequencies, useful vertical launch angles, and the degree of coverage achieved have been studied. In this report the results of a number of studies have been used, with the intent of showing a representative example of frequency spans required (although specific required frequency extremes will vary with site), vertical launch angles necessary, and distances of effective operation. For most of the information given, the radar location can be taken as between 30 and 40 degrees geomagnetic latitude looking generally toward the nearer geographic and magnetic pole, with the magnetic pole the more distant (that is, in the old CRPL W zone looking south or the E zone looking north). For the signal-to-noise ratios given, the basic noise data have been taken for the eastern hemisphere as given in CCIR Report 322 (Ref. 3); however, these data have been modified to fit experience with narrow-band coherent pulse doppler radar.

PROBLEM DEFINITION

The radar will be taken as a narrow-band (5 kc) coherent pulse doppler system, where this restriction is important in setting the noise background. The approach that will be followed is to select a value corresponding to a set of radar parameters and a target size and then determine the performance that the ionospheric path permits. Table 1 gives a form of the radar range equation; the specified parameters are:

Note -- At the time the work reported here was performed, Mr. D. L. Lucas was working for the Institute for Telecommunication Sciences and Aeronomy, Department of Commerce.

Table 1
Examples of σPG^2T and Required Output Signal-to-Noise Ratio, and a Statement of the Radar Equation

σ (m^2)	P (kw)	G (db)	T (sec)	REQ $[s/n]$ (db)
1000	200	25	2.5	10
250	200	25	10.0	10
31.3	400	28	10.0	10
10.4	600	28	20.0	10

$$\left[\frac{s}{n}\right] = \frac{\sigma PG^2\lambda^2 T}{(4\pi)^3 R^4 NL}$$

$[s/n]$ output signal-to-noise ratio
σ target radar area
P average transmitted power
G antenna gain
λ wave length
T integration time
R radar range
N noise power per cps
L propagation loss

$$PG^2T\sigma = 137 \text{ db}$$

where

P = transmitter average power above a watt,
G = antenna gain above an isotropic radiator in free space,
T = predetection integration time over a second, and
σ = target radar area over a square meter.

Obviously various trade-offs between power, gain, time, and target area are possible for the same problem solution, and several examples are given in Table 1. It is well to note that transmitted power is the only variable that gives a linear improvement of signal-to-noise ratio without limit. The ionosphere's roughness (spatial variability of ionization density) and motion or turbulence of this roughness sets a limit on length of coherent integration time that can be effective. This same roughness diffuses, redirects, or defocuses the energy in an antenna beam, with the proportional diffusion increasing with increasing gain, and thus the effective gain for use in the radar equation cannot increase linearly with absolute gain. Because of the time-varying ionospheric structure, the values of G and T that can be correctly used in the radar equation tend to be mutually restrictive when extremely large values are considered; for example, if G becomes very large (due to a very narrow horizontal beamwidth), the T that can be effective approaches a very small period. Here it is well to recall that how various factors fit in the radar equation is not the only set of requirements; signature recognition and discrimination needs may place emphasis on doppler resolution, angular resolution, angular spectrum, range resolution, or a combination compromise. These factors and hf radar experience have been given consideration in selecting $PG^2T\sigma$ = 137 db. Values of T up to ten seconds can be effective a large part of the time (4,5); but the limitations on G when used in the radar equation have not been adequately determined (although estimates have been that up to ten wavelengths in antenna horizontal aperture can be effective).

PROBLEM SOLUTION FORM

The raw material upon which the propagation predictions are based consists of:

1. Worldwide vertical incidence ionosonde data giving measured values f_0F2 and the M-3000 factor

2. Observed variations in signal amplitude over various paths

3. Worldwide noise-measurement records (Ref. 3).

The ionosonde results have been used as a base to approximate the upper-atmosphere charge composition by two parabolic electron distributions. The lower distribution, corresponding to the E layer, is considered completely predictable by means of location, solar zenith angle, sunspot number, and an empirical factor. At each geographic location the upper electron distribution corresponding to the F2 layer is approximated by a parabola, the height, semithickness, and maximum electron density of which is described by monthly median values for each hour of the day plus a statistical distribution of electron density values. The F1 layer is not treated per se, but the parabolic fits are such as to include F1 effects in elevation-angle predictions.

Path loss is treated in two steps:

1. One term, called the quasi-minimum loss, is considered completely predictable nondeviative absorption, much in the same manner as the regular E-layer is predicted. Ground-reflection losses where appropriate are treated as completely predictable.

2. A second term, called excess system loss, is derived from measured signal-strength variations over a number of different length paths. This loss term is a function of geomagnetic latitude, season, local time, and path length. It is used in the form of hourly medians and the statistical distribution about the median. This loss term has absorbed within it such losses as those due to polarization mismatch, focusing and defocusing, and deviative absorption, in addition to any variations in nondeviative absorption.

The noise-power compilations available are derived from CCIR Report 322 (3). The noise is treated as a function of frequency, geographic location, local time, and season. It is represented as an hourly median value plus a measure of the statistical distribution about this median. In the case of the study described here, hf radar operating experience has been used as a guide to modify the noise compilation, and the modification consists of setting a threshold below which the noise is not permitted to drop. Specifically the noise power per cps has not been allowed to drop under a median level of

$$N_m = 148 + 12.6 \log_e (f_{mc}/3) \text{ db below a watt.}$$

The threshold provides a median that joins -156 dbw at 6 Mc and -174 dbw at 30 Mc on a log frequency plot. This has been called the "rural noise" level, but it is not used herein as a siting factor. It is used as an experience-dictated minimum achievable noise level for a narrow-band (about 5 kc) pulse doppler radar with a frequency complement of at least one channel per megacycle at the lower frequencies. An example for the basis of applying this condition is given in Fig. 1.

Using the material that has been described, the radar equation of Table 1 is solved where each complete computation is in effect a ray trace between the radar and the target, with a path loss and a noise assessment. Horizontal ion density has been held

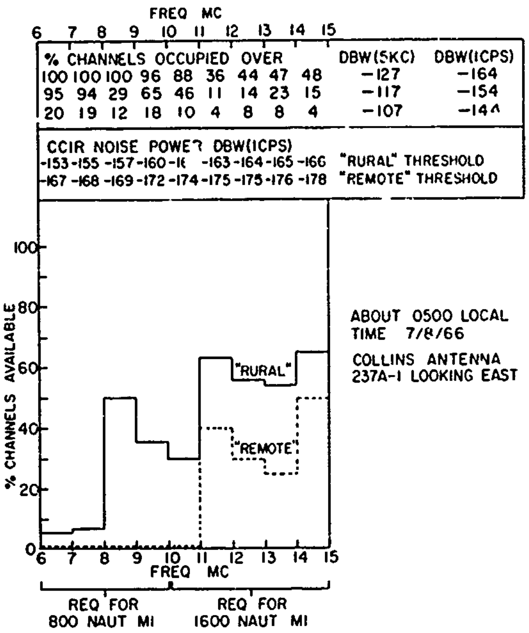


Fig. 1 - Tabulation of 5-kc channels in a 1-Mc band that have either a signal or noise level greater than the designated levels. Directly below are tabulated the CCIR noise powers or the designated thresholds, whichever is greater. Using this type of data, channels available, defined as channels with less noise or interference than the above tabulation, are given versus frequency. This sort of data has provided the basis for the frequency complement and noise model used.

constant for each individual ray trace. The results of computation are given in the form shown in Table 2. Time of day was varied in two-hour steps, season was represented by separate tabulations for summer, winter, spring/fall (i.e., June, December, March). The sunspot number was varied in the following steps: 10, 50, and 100. Distance steps starting at 500 naut mi were 100 naut mi at the shorter and 200 naut mi at the longer ranges. The frequency complement consisted of a narrow-band channel at nominally 6, 7, 8, 9, 10, 12, 14, 16, 18, 21, 24, 27, and 30 Mc. The items in the printout are somewhat self-evident, but an explanation may be in order.

1. Mode: The mode, 1E, 2E, 1F, 2F, etc., for which the ray trace between radar and target is accomplished at the specified frequency.

2. Angle: The average takeoff and arrival angle associated with the above mode.

3. Prob: The probability (percent days within the month) that the above mode exists with the quasi-minimum loss (i.e., propagation by refraction — not scatter).

4. Delay: The one-way time delay of the path for the mode expressed as tenths of milliseconds.

5. Noise: The predominant noise (atmospheric, cosmic, or threshold) given as the hourly median noise power per cps in decibels below one watt.

6. FS Loss: The round-trip free-space loss between two isotropes spaced by the appropriate distance, that is, $(4\pi R/\lambda)^4$.

7. P. Loss: The two-way quasi-minimum loss associated with the path. (The excess system loss has been applied once in the computations, but is not printed out.)

Table 2
Example of Computer Printout of the
Radar Problem Solution

36 MAR SSN= 100. 36.020
AZIMUTHS N.MILES
180.0 360. 2001.3
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 600
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	11.5														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	3	1	1	1	1	2	3	-	-	-	-	-	-	-	ANGLE
	50	99	99	95	89	76	35	-	-	-	-	-	-	-	PROB.
	130	128	128	128	128	129	130	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	250	239	242	244	246	248	251	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	14	2	6	8	11	12	14	-	-	-	-	-	-	-	S/N..DB
	92	27	52	69	82	87	94	-	-	-	-	-	-	-	S/N..PROB.
														92	=T.REL.
4	16.6														
	1F	3F	2F	2F	2F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	2	20	13	12	12	1	0	0	1	1	-	-	-	-	ANGLE
	50	99	99	99	97	99	97	86	60	27	-	-	-	-	PROB.
	129	137	132	131	131	128	127	128	128	128	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	257	239	242	244	246	248	251	254	256	258	-	-	-	-	FS.LOSS
	4	58	36	32	28	12	8	6	6	4	-	-	-	-	P. LOSS
	13	-41	-21	-15	-10	4	8	11	13	14	-	-	-	-	S/N..DB
	92	0	0	0	2	40	70	85	91	95	-	-	-	-	S/N..PROB.
														89	=T.REL.
6	23.5														
	1F	4F	3F	3F	2E	2F	2X	1F	2F	2F	1F	1F	1F	-	MODE
	1	27	21	19	3	12	6	1	12	14	0	1	1	-	ANGLE
	50	99	99	99	99	99	99	99	75	46	76	44	13	-	PROB.
	128	144	138	136	126	132	127	128	131	133	127	128	128	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	263	239	243	244	246	248	251	254	256	259	261	263	265	-	FS.LOSS
	6	136	96	84	70	46	36	16	24	22	8	6	4	-	P. LOSS
	14	-119	-80	-68	-52	-29	-19	2	-6	-3	11	14	15	-	S/N..DB
	93	0	0	0	0	0	0	28	6	13	85	94	96	-	S/N..PROB.
														79	=T.REL.
8	27.1														
	1F	2E	2E	3F	2E	2E	2E	2X	1F	2F	2F	1F	1F	1F	MODE
	1	3	3	20	3	3	3	5	0	11	14	0	1	1	ANGLE
	50	99	99	99	99	99	99	95	98	72	43	71	50	25	PROB.
	128	126	126	138	126	126	126	127	128	131	133	127	128	128	DELAY
	174	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	265	239	241	245	247	247	251	254	256	258	261	263	265	267	FS.LOSS
	6	190	148	106	94	80	48	38	18	28	22	8	6	6	P. LOSS
	12	-175	-132	-91	-78	-64	-31	-21	0	-9	-4	11	12	15	S/N..DB
	89	0	0	0	0	0	0	0	16	3	10	83	89	95	S/N..PROB.
														75	=T.REL.

8. S/N DB: The hourly median signal power, assuming the mode exists, divided by the hourly median noise power per cps given in db. Note that this value is not necessarily identical with the median S/N, although it generally is near that value.

9. S/N Prob: The probability that the available signal-to-noise ratio exceeds the required signal-to-noise ratio, considering only the fluctuations of the signal and the

noise (that is, considering signal and noise distributions about their hourly medians). The probability of ionospheric support or mode existence is not included.

At this point the computations will be reviewed. For each SSN, season, range, and two-hour time block a set of ray traces are performed, starting with the monthly median maximum usable frequency (MUF column in Table 2). Then successive ray traces are made for each increasing frequency step between 6 and 30 Mc, stopping when the probability of path existence drops below 10 percent (that is, when that frequency is useful less than 10 percent of the days in the month). For each ray trace a mode, average take-off angle, average time delay, free-space spreading loss, and quasi-minimum path loss are printed, plus the probability that the ray trace exists. This step completes the computations intimately associated with the path that are displayed. The noise is explicitly from CCIR Report 322 (3) or the threshold interpolated such that it is the hourly median for the appropriate location, time, and season. The ratio of the median signal power to the median noise power is obtained using all path losses, where the excess system loss is the sole fluctuating signal factor (and it is a function of coarse distance). The probability that the signal-to-noise ratio exceeds that specified (6 db for a 1-cps noise bandwidth), S/N Prob is computed considering the fluctuations of both signal and noise, and assuming the path exists.

It is evident that a means of combining these various probabilities is required if the time of effective radar performance is to be estimated. The concept of circuit reliability will be used for assessment where reliability is defined as the probability that the required signal-to-noise ratio will be met or exceeded at the designated hour. A reliability, R, has been computed for each frequency step based on (a) the probability of ionospheric path support, (b) the probability that the required signal-to-noise ratio is met, and (c) the product of (a) and (b) above; this product, called reliability, has not been printed in Table 2. Such a reliability provides a measure of how effective the radar may be for a chosen frequency. However, it is desired to know how well the radar can be expected to work, assuming the selected channel complement is available and operation is on the best channel. To effect such an assessment a total combined reliability has been computed and printed out as T. REL. The purpose of the calculation was to combine the reliabilities at distinct frequencies within the complement to estimate the reliability of a complete frequency complement when the frequencies were readily accessible. This means that the time lost in changing the frequency of operation must be zero.

Three assumptions were made:

1. The transmission characteristics at frequencies 15 percent above or below the highest frequency possessing the highest reliability are distinctly different.

2. These events may be regarded as statistically independent.

3. Operation is desired on the highest possible frequency, i.e., if 9 Mc and 12 Mc both possessed the same best reliability R_1, then 12 Mc would be chosen as the frequency for R_1.

The frequencies of the complement lying at least 15 percent below the frequency corresponding to R_1 are then inspected to find R_2, which is the greatest reliability of the above frequencies. Reliability R_3 is found on the upper side of R_1 in a similar manner.

The combined probability of the R's is then an estimate of the total reliability of the frequency complement. The formula used is:

$$T.REL. = R_1 + R_2 + R_3 - R_1R_2 - R_2R_3 - R_1R_3 + R_1R_2R_3 .$$

This factor, *T. REL.*, is intended to provide a first approximation of the probability of effective operation in a two-hour time block. When averaged over a day, year, etc., it will be considered a measure of the time the radar is effective.

The basic presentation of the problem solution is in the form shown in Table 2. The complete set of printouts is too voluminous to be appropriate for inclusion in its entirety. Computer printouts for three sunspot numbers at ranges of 500, 1000, and 1800 naut mi are given in Appendix A. This appendix can be examined for examples of variation in performance. Attention is called to a point of possible confusion in this report. In Table 1 the output signal-to-noise ratio is designated as s/n, and the noise power per cps is given as N. In the computer printout (Table 2), S/N is signal power divided by noise power per cps for a 200-kw transmitter, 25-db gain antenna, and a 1000 m^2 target. The total reliability has been computed on the basis of a required S/N of 6 db to correspond to s/n of 10 db after 2-1/2 seconds integration time. So, the problem solution for

$$PG^2T\sigma = 133 \text{ db with a required } S/N = 6 \text{ db}$$

is also for

$$PG^2T\sigma = 137 \text{ db with a required } s/n = 10 \text{ db.}$$

In making trade-offs between P, G, T, σ, and required signal-to-noise ratio, some care must be exercised.

The complete solution has been used to obtain measures of frequency requirements, vertical launch angles used, and proportion of time that one can expect effective operation.

DIURNAL VARIATIONS

The nature of the diurnal variation in signal-to-noise ratio can be used to illustrate the character of radar performance. In Fig. 2 the ratio of median signal to median noise for the monthly median MUF is plotted versus hour of day. The noise is that in a 1-cps band, and the dotted line at 6 db corresponds to a 10-db postintegration signal-to-noise ratio. This dotted line approximately marks the 50-percent probability of achieving the desired signal-to-noise ratio, assuming the median MUF propagates. Thus interpretation of these curves as absolute performance indicators is not possible. Figures 3, 4, and 5 show the expected performance in June, SSN 10, for the designated frequency complement and the assumed controlling noise. For comparison the percent reliability of the monthly median MUF, the most reliable single frequency, and the Total Reliability are given. The curves show that for the specified radar, serious performance deterioration is at the longer ranges during summer middays. This fact illustrates an important feature of hf radar, namely, that some deficiencies in detection capability can be quite predictable and regular in occurrence.

FREQUENCY REQUIREMENTS

Frequency spans required are an important feature in radar design and cost. Since absolute values of frequency would be dependent upon location, look directions, and reliability desired, a simplified analysis will be used. The median MUF that gives a 10-db postintegration median signal to median noise ratio, s/n, is used to set the upper frequency bound. The lower bound is set by the lowest frequency that provides the 10-db signal-to-noise ratio unless the minimum range of 500 naut mi or minimum frequency of

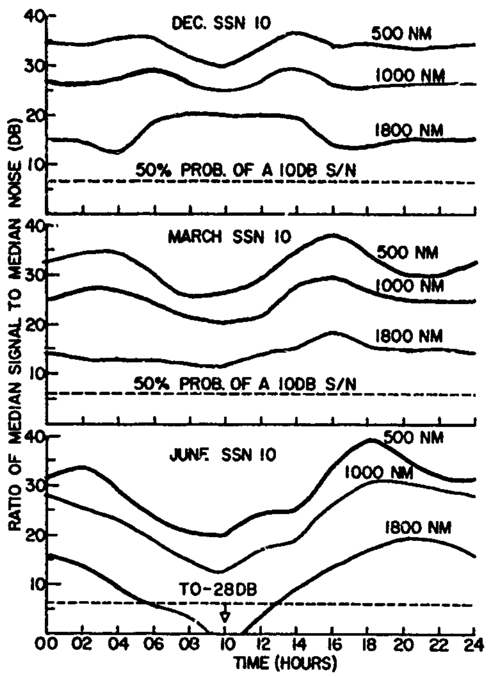


Fig. 2 - Expected diurnal performance at one SSN for three ranges and three seasons. The radar is as specified in Table 1, and the poor performance occurs in summer midday at long range.

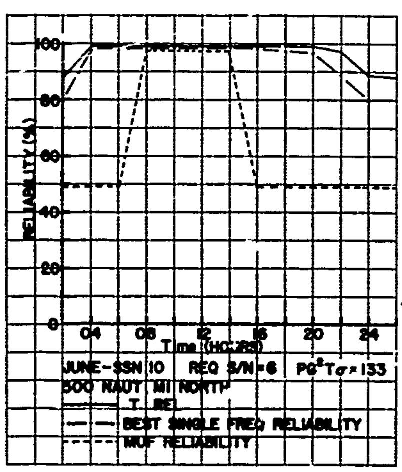


Fig. 3 - The reliability of the median MUF, the reliability of the best single frequency in the complement, and the Total Reliability are given for a 500-naut-mi case. The E layer provides the median MUF path between 0800 and 1300 hours.

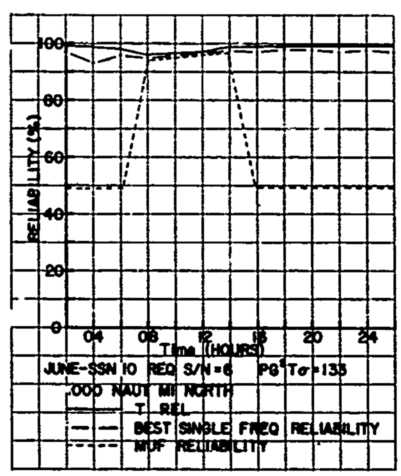


Fig. 4 - The reliability of the median MUF, the reliability of the best single frequency of the complement, and the Total Reliability are given for a 1000-naut-mi case. The E layer is seen to provide the median MUF path between 0800 and 1300 hours.

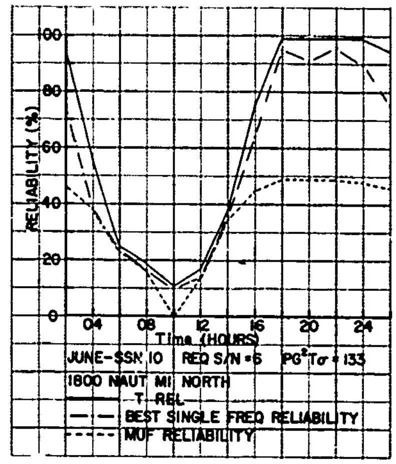


Fig. 5 - The median MUF reliability, the best single frequency of the complement reliability, and the Total Reliability for an 1800-naut-mi case. This provides one example of how Total Reliability compares with the best single-frequency reliability.

6 Mc occurs first. Figures 6 and 7 are examples of the data presentation. Figure 6 shows a severe case in which at 0800 hours four frequencies are required to obtain coverage from 500 to 1600 naut mi, with no coverage indicated beyond 1600 naut mi. In Fig. 7 are examples in which for several hours only one frequency is required to permit coverage from 500 to 2000 naut mi. This form of presentation is intended to indicate the frequency spans useful and the number of different frequencies required for distance coverage. The stepped structure of the analysis in distance, frequency, and hours prevents the results from being smooth or quite complete. The abbreviated long range at 2000 hours and 10 Mc in Fig. 7 is an example of the effect due to critical frequencies decreasing and layer height increasing as the refracting region moves toward the pole. This is a frequent characteristic of north-south paths. The complete set of frequency requirements is given in Appendix B. Examination of the complete set shows that considering ranges between 500 and 2000 naut mi, several conclusions can be drawn, namely: (a) that most of the time two frequencies are required, (b) that three frequencies permit coverage a large part of the time, (c) that some coverage failure exists at the nearer ranges (due to the arbitrary 6-Mc lowest frequency), and (d) that appreciable deficiency in coverage occurs at the longest ranges.

From a group of plots as shown in Appendix B, it is not possible to appreciate the factors that govern frequency requirements. One example showing what various available frequency spans provide in the way of performance may be instructive. Figure 8 shows plots of S/N versus hour for SSN 10, Mar./Sept., and an 1800-naut-mi range; a 50-percent or better probability that the path exists has been required. Restricting radar operation to 6 Mc never permits the median signal over median noise ratio to be achieved. Permitting the upper operating frequency limit to increase to 14 Mc results in improvement with each step increase. The step from 14 to 16 Mc in upper limiting frequency shows a dramatic increase in performance capability, 19-db maximum, for the middle daylight hours, and this improvement is due to the higher frequency providing 1F coverage, where 2F was required for the lower frequencies during midday. This type of performance improvement by higher frequency operation occurs often at the longer ranges, and this feature is one of the essential reasons for a high upper frequency limit.

The basic frequency span used in this study is 6 Mc to 30Mc, where 6 Mc is an arbitrary choice and the 30-Mc limit was set by the computer noise-data compilation. Since the utility of the higher frequencies is of interest, a subsidiary study was made for

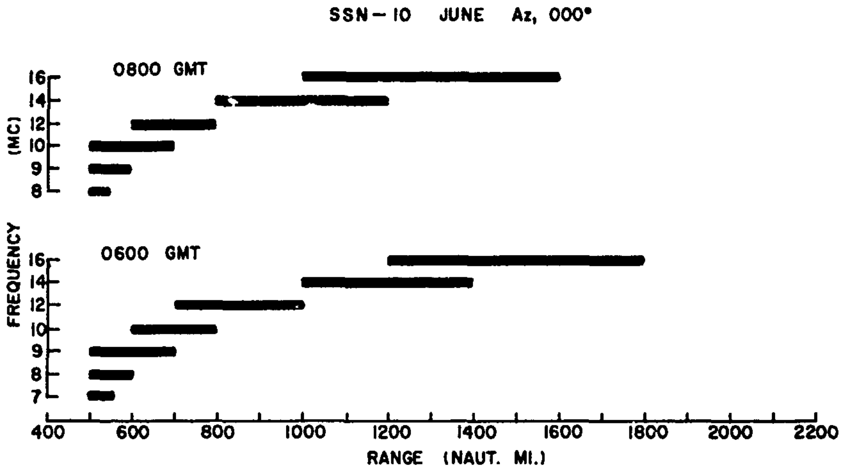


Fig. 6 - The ground ranges for various frequencies in summer. The criteria are that the upper frequency and distance bound is set by the median MUF that delivers a 10-db postintegration signal-to-noise ratio and that the lower bound is set by the lowest frequency that delivers a 10-db postintegration signal-to-noise ratio, unless the minimum range of 500 naut mi or minimum frequency of 6 Mc occurs first.

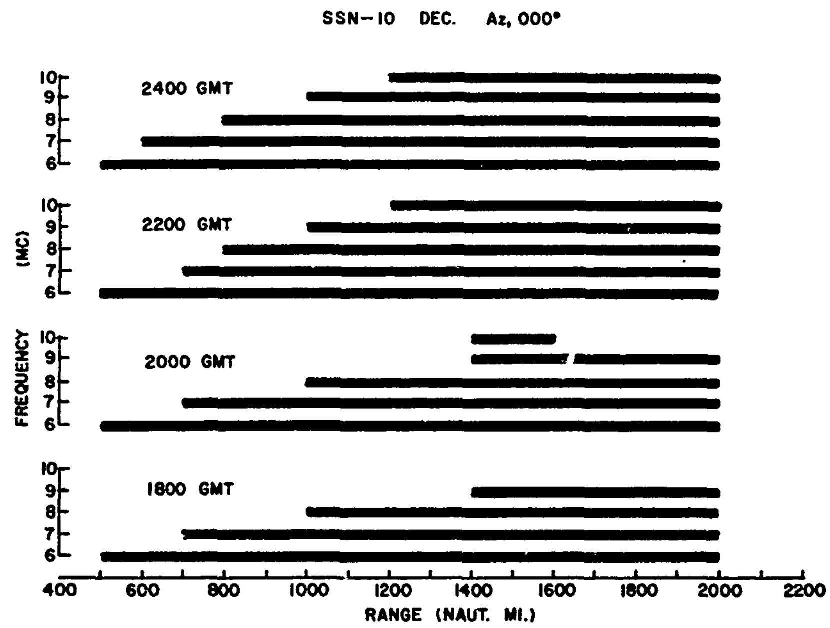


Fig. 7 - The ground ranges for various frequencies in winter. The criteria are that the upper frequency and distance bound is set by the median MUF that delivers a 10-db postintegration signal-to-noise ratio and that the lower bound is set by the lowest frequency that delivers a 10-db postintegration signal-to-noise ratio, unless the minimum range of 500 naut mi or minimum frequency of 6 Mc occurs first.

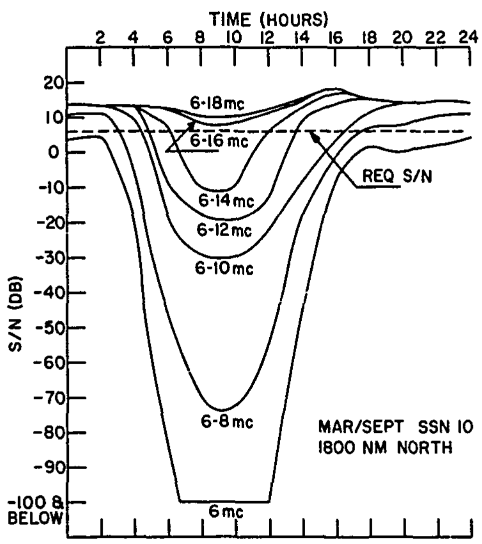


Fig. 8 - An example of what various frequency bands offer in the way of performance. This illustrates a striking feature of hf radar, namely that if achieving a 6-db S/N for ten hours out of the day were satisfactory, a single frequency at 8 Mc would suffice, but that if 24 hours of 6-db S/N is required, the frequency band between 8 and 16 Mc must be used. High reliability requires extreme versatility in the hf radar, and the frequency demands demonstrated here are for just one SSN and season.

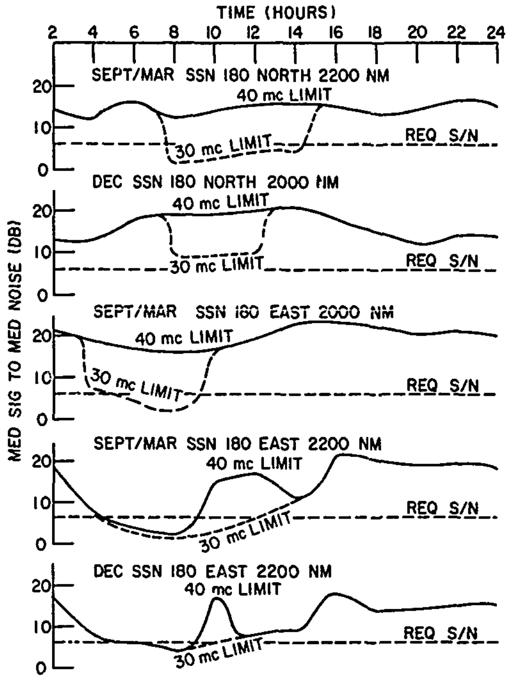


Fig. 9 - Diurnal plots of signal-to-noise ratio for a 30-Mc and a 40-Mc upper limit. At the indicated long ranges, seasons, directions, and SSN = 180, the cases are treated where significant performance improvement is afforded by the 40-Mc upper frequency bound.

a high SSN, where the 30-Mc noise was used for all frequencies above 30 Mc; the actual noise should be lower in level. Figure 9 gives the results of this study as S/N plots for a 30-Mc and 40-Mc upper frequency limit. At the indicated ranges, seasons, and directions the 40-Mc limit can be seen to provide 10 to 15 db improvement for several hours per day. The better performance provided by permitting higher frequencies is achieved because coverage is afforded by a 1F mode.

ELEVATION LAUNCH ANGLES

The gain requirements in the vertical plane are important in radar antenna type selection and detailed design. Figure 10 gives average launch angles for distances of 500, 1000, and 1800 naut mi on a percent time useful basis. These angles are for summer and SSN = 10; however, requirements for other seasons and sunspot numbers, while not identical, are similar. Figure 11 gives useful elevation launch angles as a crosshatched area versus range for SSN = 10 and June. This form of presentation has been used to summarize the angle requirements, and Appendix C contains the complete set. The plots are arranged according to season and sunspot number. Angles that are set by E-layer propagation are marked E. The E-layer paths computed here occur in

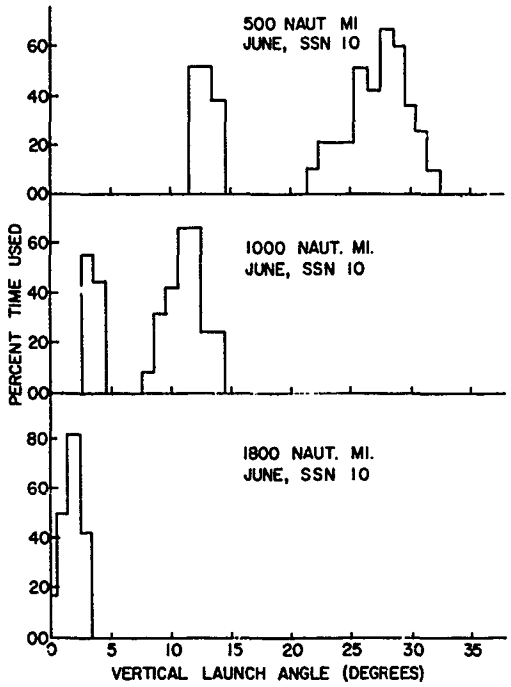


Fig. 10 - An example of average launch angles on a percent time useful basis. Considerable deviation from the average can exist.

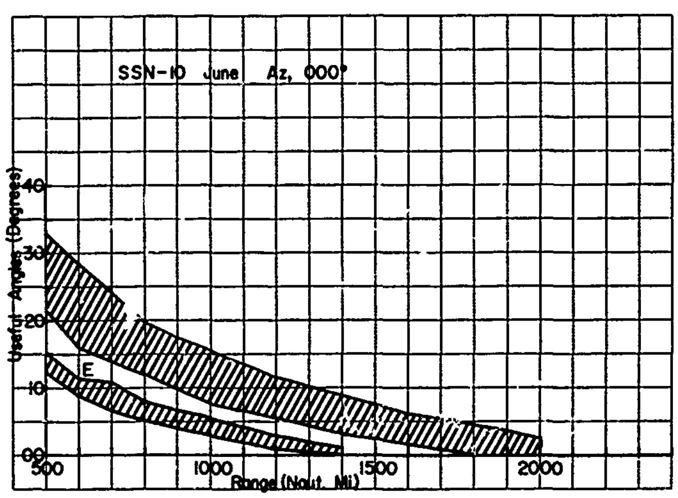


Fig. 11 - The spread of average launch angles that provide a 10-db postintegration signal-to-noise ratio, shown as cross-hatched areas. The coverage provided by the E layer is marked E. This example is for summer and SSN = 10.

daytime exclusively, and their importance has not been sufficiently emphasized, because sporadic E has been neglected. The useful angles have been selected on the basis that s/n = 10 db or better, and angles for paths useful less than 10 percent of the time have not been included. Examination of the plots show that all angles between 0 and 38 degrees are of use. By using the E-layer for daytime shorter range operation, the requirement for angles above 30 degrees can be made less demanding. However, it is clear that angles down to zero degrees are useful, and further that any abridgement of the low-angle extent will result in a reduction in longer range performance. The effectiveness of sets of vertical launch angles can be displayed, and one example is given in Appendix B. In the context of the problem that has been set up, 2F coverage using larger elevation angles can fill in for the low angles, but with a performance loss; however, the 2E case is seldom useful. It is evident that if distance performance is to be optimum, the long-range 1E and 1F modes must be used. If angles down to zero degrees are planned, either a very high antenna or a very large earth surface antenna system is required, plus siting on appropriately sloping terrain.

TOTAL RELIABILITY

The total reliability (T. REL.) can be considered equivalent to the proportion of time the radar can be effective in detecting the target. If confidence in the noise and propagation input data is 100 percent, the gain and integration time are effective values, existing propagation conditions are properly assessed, and the radar operated correctly, T. REL. should be exactly the percent time of effective operation. Such perfection is not realistic, but T. REL. should offer a good first approximation to effective operating time. It should be noted that T. REL. is a function of the available frequency complement, which for this study was a narrow-band pulse channel at nominally 6, 7, 8, 9, 10, 12, 14, 16, 18, 21, 24, 27, and 30 Mc. Figure 12 shows a comparison between T. REL. (percent time) for channels available in megacycle steps and two-megacycle steps for one day at long range; in this case the larger frequency complement gives about a 5-percent increase in T. TEL.

Considering T. REL. an indicator of effective operating time, it has been averaged over a day. Figures 13 through 15 show percent time coverage for the several seasons and sunspot numbers considered. Figure 16 shows the coverage by year for the three sunspot numbers, assuming performance can be equally divided among the four seasons.

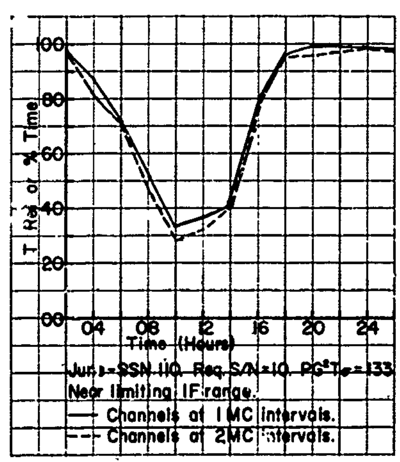


Fig. 12 - An illustration of the dependence of Total Reliability or percent effective time upon frequency complement

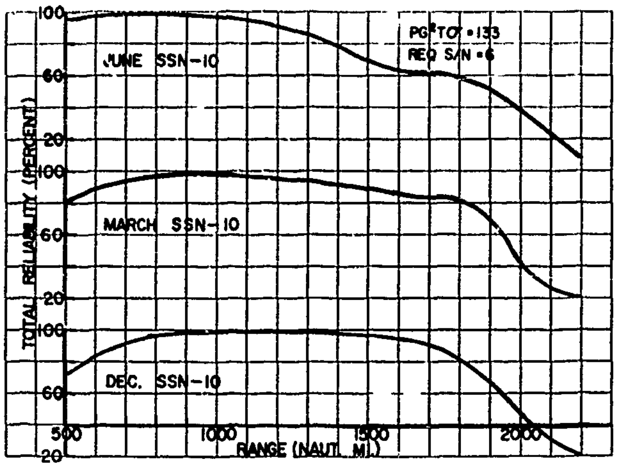


Fig. 13 - Total Reliability averaged over a day, given as a function of range for the three seasons and SSN = 10

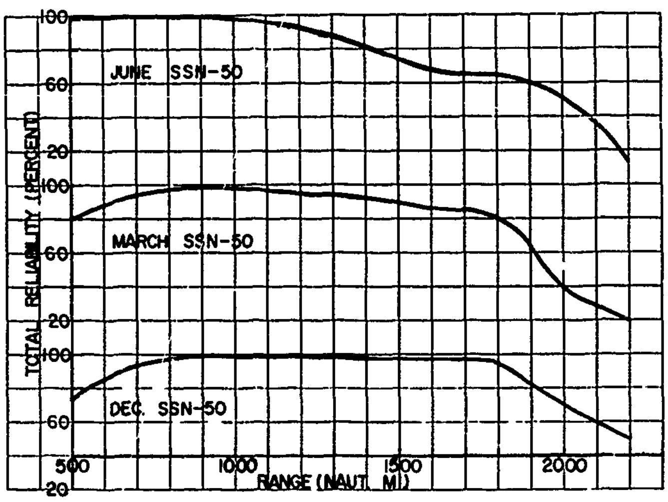


Fig. 14 - Total Reliability averaged over a day, given as a function of range for the three seasons and SSN = 50

Figure 17 shows coverage over the entire sunspot cycle, assuming the cycle spends equal times at the numbers 10, 50, and 100. Effective times of operation that are indicated are 95 percent for ranges between 600 and 1300 naut mi, slightly below 90 percent at 500 naut mi, 85 percent at 1800 naut mi, 60 percent at 2000 naut mi, and 40 percent at 2200 naut mi. By permitting frequencies below 6 Mc, the 500-naut-mi time could be improved; however, improvement at the longer ranges requires a higher performance radar, that is, higher power, increased antenna gain, or longer signal processing times. As has

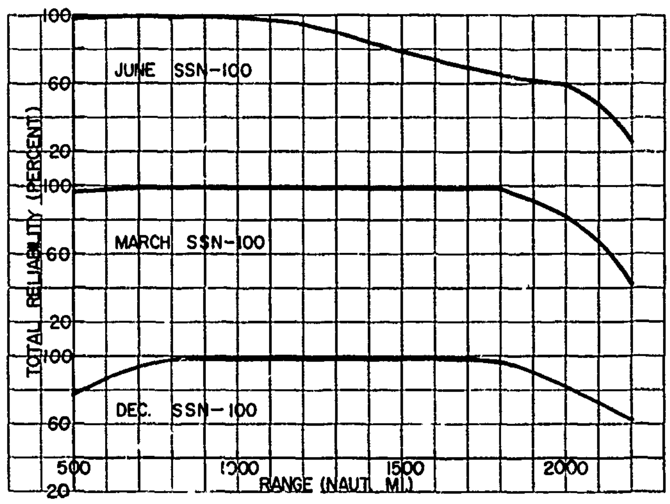


Fig. 15 - Total Reliability averaged over a day, given as a function of range for the three seasons and SSN = 100

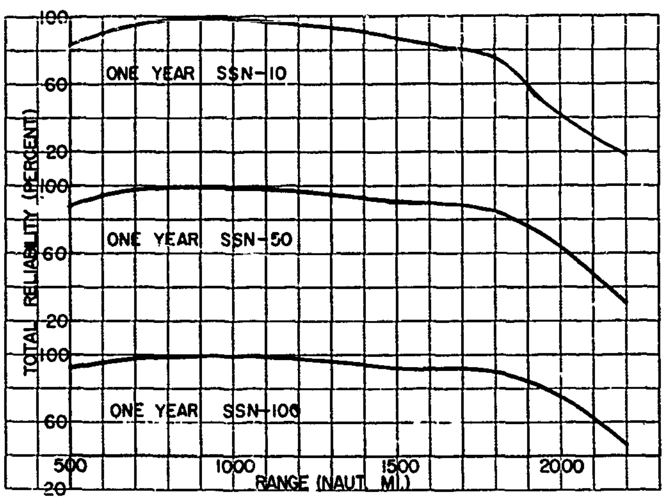


Fig. 16 - Total Reliability averaged over a year, given versus range for SSN = 10, 50, and 100

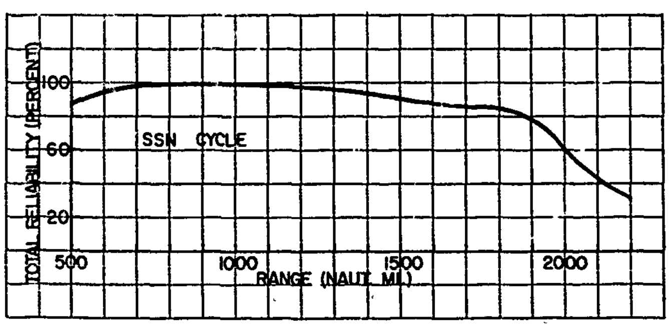


Fig. 17 - Total Reliability average, given as a function of range

been mentioned before, improvement by increasing antenna gain and processing gain has limitations. It should be remembered that during years of high sunspot number the long-range coverage can be improved by operating at frequencies above 30 Mc.

ASSESSMENT OF RESULTS

A method for predicting hf radar performance has been outlined, and some results from application of the method have been given. It may be well to discuss some of the limitations of the treatment and their impact upon the results.

1. System-generated noise: the earth echo (backscatter), meteor head, and trail echoes, auroral returns, etc., have not been considered. It is assumed that desired targets are missiles or aircraft and that the other above-mentioned echoes are responses of confusion. If the radar signal processor properly recognizes azimuth, range, range rate, and rate of range rate, nearly all confusion can be eliminated; however, it must be admitted that a one-hit radar, even with the narrowest of azimuthal beamwidths and the shortest pulse length, would be confused to the point of uselessness by the earth echo alone. Thus, if signal processing matches and displays the known target characteristics, and if sufficient target-identification features are employed, recognition can be achieved with a very small false-alarm probability. Perhaps it should be stated here that the signal-processing times given in Table 1, 2-1/2 to 20 seconds, give a misleading impression of the length of "looking" time that may be required for securing a very high probability of detection; the hf signal is indeed a fading one, and for aircraft echoes the fade period can be slow (5-7) on the order of a minute.

2. Complete outages due to ionospheric disturbances were not included. The empirical data which were used in the computations were collected for nearly all ionospheric conditions, but just how much might have been omitted due to severe disturbances is difficult to assess, since the line which marks the time of complete outage is hard to draw. About the best that can be said is that complete outages are expected to constitute a very small proportion of time (a few percent at middle latitudes).

3. The noise is a very important factor in setting performance levels. Noise was taken to be as described by CCIR Report 322 (3), modified by the "rural" threshold and fed into the radar as though isotropic. The threshold is supposed to be a feature of the site; however, in this case it was imposed on the basis that experimentally it has been difficult to find sufficient narrow-band channels (5 to 10 kc) with noise levels lower than the rural level. It should be emphasized that the actual controlling noise is a strong function of radar operating philosophy. Some techniques require pirating wideband frequency channels, and in fact several operating hf radars pirate their frequencies; if such operation is used, the actual noise is a function of required bandwidths and band occupancy and is difficult to describe or predict, except that in general the noise levels will be higher than those used herein (8,9). On the other hand, if a quite narrow-band (less than 200 cps) cw radar were operated on certain selected channels, for example the same ones that are used for CCIR noise measurements, the tabulated CCIR 322 noise should serve well.

4. The sporadic E and F1 layers were ignored. This statement is not entirely true, since sporadic E (E_s) and F1 ionization contaminated the data that have been used, but as to the E_s to an unknown extent. The omission of the F1 layer is estimated to have little effect on the deduced coverage or reliability, but its existence may require the use of more frequencies than has been indicated. The omission of sporadic E is considered the more serious deficiency in the report results. In general the E_s effects will be to improve

performance between 500 and 1200 naut mi and to degrade performance beyond 1200 naut mi. Summer is the season of high incidence of sporadic E, and there is little question that the percent coverage or reliability curves for low-SSN summers are too high for ranges beyond 1200 naut mi.

5. The case treated is one in which the radar and the target are near the earth. The case for targets at any altitude could have been analyzed; however, complete inclusion of several other target altitudes would considerably expand the presentations, and this has not been done. Some general statements are:

a. For a target at altitude, the longer range one-hop distances, which become one hop minus, are reduced.

b. Coverage for targets at any altitude below the refracting height can generally be achieved out to 2000-naut-mi distances by rays that have been reflected from the earth's surface (that is, the one-hop-plus case), but an additional ground-reflection loss will occur. The longer range S/N can be somewhat poorer for targets far above the earth surface; however, the mode availability of one hop plus and minus for targets at altitude doubles the available modes, in comparison to the near-surface target, giving better coverage possibility and a comparable total reliability. A specific example at near limiting one-hop range is examined in Appendix D.

6. The roughness or inconstancy of the ionosphere, both in space and time, have not specifically been taken into account (although it was mentioned that such roughness limited the amount of coherent processing time and antenna gain that can be effective). In fact, for each individual ray trace, horizontal ionization density, and height of maximum ionization has been held constant. There simply is not enough information on the more or less random roughness and motion to treat it adequately in a study at this time (10,11). The hour, longitude, and latitude variations of ion density are in the data from which this study is made on a monthly median basis. Horizontal gradients, or "tilts," could have been included in the computations, based on monthly median values; however, this could not be justified, and it was feared that such a treatment might be worse than none at all. In brief, a "tilt" computed from monthly median values, deduced from widely spaced ionosondes, is not necessarily the same as the real monthly median tilt. Further, experience suggests that refracted ray paths in the F layer are nearly always tilted, and that the tilt is constantly varying, both up and down. Von Handel (12) has used some average ionization gradient information to deduce that low-elevation-angle radiation is useless to the north; since his report has aroused interest, a fuller discussion will be given in Appendix E. Here it will suffice to say that any reduction in low-angle coverage will certainly impair both medium and long-range performance. It is hard to estimate how much effect ionospheric irregularities may have on the performance predicted; however, some of the effects are no doubt already absorbed in the excess system loss. A radar provided with a continuous analysis and display of the earth echo could have a real-time evaluation of these effects (4).

The Naval Research Laboratory has about five years' experience with an hf radar where the $PG^2T\sigma$ product has been frequently as high or higher than the 137 db specified for the problem treated herein (7). This is an experimental system of limited frequency span (13.5 to 27 Mc), and it has been used over less than one half of a sunspot cycle. For the most part, frequency channels used have been those allocated for Washington area Navy radio transmissions and on a not-to-interfere basis. This experience fits the predicted performance by methods as given in this report well enough to provide confidence in the technique, even though the experimental data samples are limited. A lower summertime depression in long-range coverage is the significant deviation between

experimental observations and predictions. The experimental evidence in hf radar operation is not in serious conflict with the prediction method that has been used. The performance-prediction method is about as good as is going to be done on the present base of data without a more sophisticated and complex model, and the prediction method does furnish a good indicator of expected performance, but perhaps not as detailed or absolute as desired. The method does provide a good basis for studying trade-offs between times of effectiveness and various design parameters. That is, losses in coverage time as a function of frequency upper or lower limit, average elevation launch angle, etc., can be determined with confidence. Meaningful effectiveness studies can be made, and this is considered a major contribution of the prediction techniques described here.

PREDICTION IMPROVEMENT

The prediction method that has been described in previous sections will be reviewed here. In brief, the ionosphere was approximated by two parabolic electron distributions. The lower or E layer was considered completely predictable. The higher or F layer was treated using the height and semithickness of the monthly median. The electron density was treated as a probability function on a days-out-of-the-month basis. The transmission loss was divided into a spreading loss, a completely predictable D-layer absorption loss, and an excess system loss; the excess system loss is in statistical form and is treated as the cause for day-to-day signal variations. The controlling noise has been taken from CCIR 322 (3), modified to suit the radar mode of operation. The lack of a good noise description is one of the more important deficiencies in hf radar performance prediction. The required inputs for a study are the hour, month, SSN, radar and target location, frequency complement, and the radar and target description. To repeat, the analysis is based upon monthly median values, except for F-layer ion density, excess system loss, and the controlling noise, which are given as statistical distributions. Ray traces are made yielding time delay, launch angle, transmission loss, and signal-to-noise ratio.

The aim in this study has been to be sufficiently complete to usefully predict performance and still provide a method quick, easy, and cheap enough that the various problems that need study will be analyzed. Improvements in the method should be examined in the context of this philosophy.

Several improvements are possible — not in technique, but in including more data. Inclusion of expected effects due to the E_s and F_1 layers are examples. Extensive improvement will require a more complete treatment of the data base with a more sophisticated model. It may be that really significant improvement will require that more of the physical characteristics of the ionosphere must be measured, scaled, and mapped. Work on prediction-method improvement is being continuously prosecuted at ITSA and other agencies.

It is felt that data accumulated from operating an hf radar will provide a means for significant improvement in ionospheric assessment. For example, a radar with an aircraft-detection capability can be used to measure simultaneously target signal level, backscatter level, and noise background; with a narrow and steerable antenna beam, mode and actual path can be identified. The aircraft returns can be used as reference signals, and this path loss can be determined and the backscatter signal can be calibrated and assessed as a reference target. Correlation between path loss and noise levels could be ascertained; there must be some correlation, although now the distributions are treated as independent. A properly instrumented hf radar employed in an intensive measurement program would provide the means for a considerably enhanced description of the ionosphere and hf circuit operation — but the program would need be long-term to be fully exploited.

EXTENDING RADAR CAPABILITY

The $PG^2T\sigma$ product of 137 db that has been used in this report was selected on the basis that it could be achieved with current technique development. It has been shown that while $PG^2T\sigma$ = 137 db is more than ample at 1000 naut mi, it does not provide near full-time coverage at 2000 naut mi. It may be worthwhile to explore some of the avenues toward extending hf radar capability.

First, an attempt will be made to characterize the propagation medium in a manner to show the fundamental limitations. The E layer is the most regular, and it can be very stable (also it is comparatively thin), such that a spherical-mirror analogue is appropriate over fairly wide bandwidths (a megacycle or more). However, the E layer, though important, does not often provide distant coverage, and it will not be discussed further. The F layer is thick; rays may spend 100 km or more vertical distance in the layer's underside. For rays that return to earth the ionization density generally is ever increasing with height; thus the refraction process is truly dispersive. The F-layer ionization is irregular, the irregularities are in motion, and the smaller dimensions of irregularities can be 10 km or perhaps smaller. The ion density may exhibit an order-of-magnitude variation over the day period. These features can depict the transmission medium as a sort of low-pass dispersive filter with phase and amplitude characteristics continually changing. On a single-frequency basis, the analog of a mirror with moving ripples is appropriate — something like the surface of a pond where several pebbles have been dropped at different places. The hf radar using the F layer for refraction has a similar problem to that of the earth astronomer viewing celestial objects; that is, targets twinkle, and no matter how big you make an antenna aperture there is a limit to the angular detail that can be realized, especially if coherent processing time is required. This elementary set of comparisons has been made in an attempt to emphasize that there are restrictions to the radar improvement that can be achieved by increasing antenna gain, lengthening processing time, and increasing bandwidth. Earlier it was said that transmitted power was the one factor that should give improved performance with increase, without limit. This statement is correct if the receiver and signal processor can handle the increasing amplitude signals without limit; and of course there is a state-of-the-art restriction here.

Several of the radar design features will be examined, and estimates will be made as to how they may be usefully improved over the examples in this report.

1. Coherent signal-processing time is perhaps the cheapest avenue to greater circuit gain, and there is no reason why provision should not be made for 20 or 30 seconds, or even longer. However, hf path and target stability set definite limits upon the length of time that can be effective. Figure 18 is an example of such limitations; this figure gives a range-gated doppler

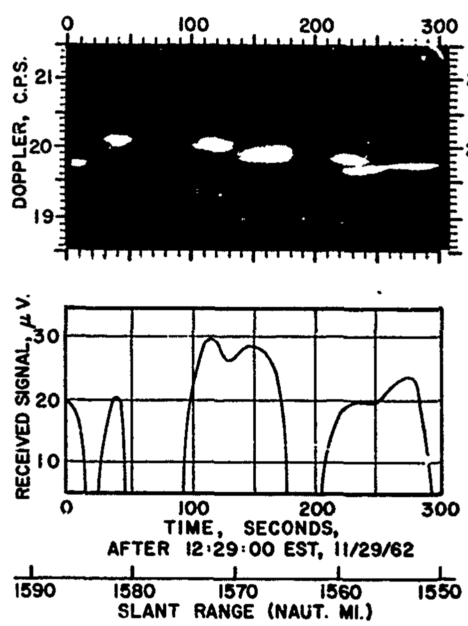


Fig. 18 - A range-gated doppler time history of a P3 aircraft target and the received signal-amplitude history. The doppler resolution bandwidth was 1/10 cps.

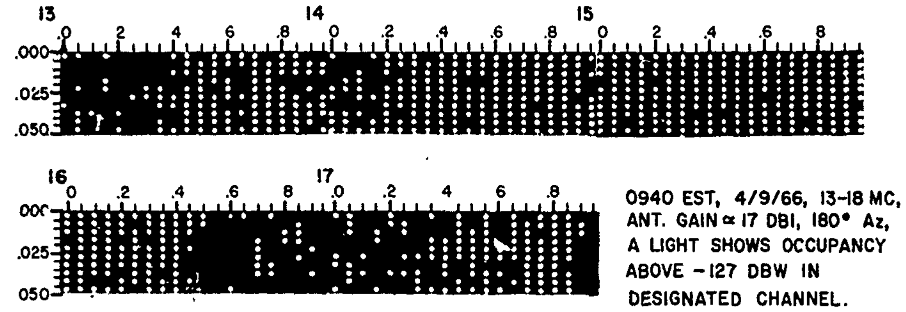
time history of a P3 aircraft target and the received signal-amplitude history. The doppler resolution bandwidth was 1/10 cps, and it is evident that ten seconds coherent processing time could not be completely effective for this target, except for the period between 250 and 300 seconds. Of course if a 10-db output signal-to-noise ratio is required, as has been done for most of the analysis given, the processing time does not all have to be coherent. A great deal of the NRL experimental work with matched filtering has used 1/3-cps predetection and 1/20-cps postdetection bandwidths; this work includes the matched acceleration filters, and the equivalent of 10 to 13 db over one-second effective processing times has been achieved for output signal-to-noise ratios of 10 db.

2. The bandwidth of emissions bears directly on range resolution, absolute range measurement, and signal-to-clutter ratio. The useful bandwidth that can be employed depends upon the variable dispersion of the path and spectrum occupancy. Absolute range measurement is generally more dependent upon path assessment than bandwidth. The capability for wide bandwidth can be incorporated and employed when useful; however, it is felt that 100 kc may be an average limit and that something like 5 kc must be considered a forced upper limit at times, if noise levels as specified in this report are to control. Figures 19a and 19b show examples of occupied 5-kc channels for a -127 dbw threshold and a -117 dbw threshold and illustrate that if a wide bandwidth is to be used for some of the required frequencies, a very high interference level must be accepted.

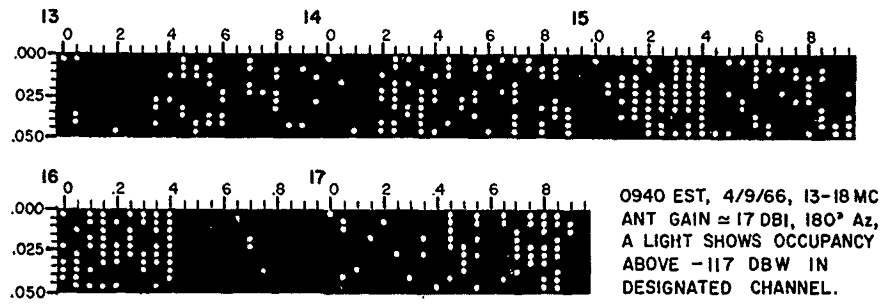
3. Antenna horizontal beamwidth reduction can add gain, increase azimuthal resolution, and improve signal-to-clutter ratio. As has been mentioned, the roughness of the path sets limits on antenna gain increase that can be used in the radar equation without a degrading factor (this has some sort of inverse relationship with processing time). The ionospheric irregularity effect on antenna pattern is probably such that the general shape is little different after refraction, but that the direction is altered. The angular spectrum is thought to have a line broadening for a single magneto-ionic component on a quiet day that can be 1/2 degree, containing rates up to tens of cycles per second (13). Three degrees deviation in angle of arrival is common within a period of the order of minutes. Reduction of horizontal beamwidth below 3 degrees is considered questionable, as far as detection improvement is concerned, although smaller beamwidths can be effective for azimuthal resolution angular spectrum studies and may be effective for clutter suppression.

4. The antenna vertical beamwidth can be reduced to a very small angle, and the gain increase will all be directly applicable in the radar equation. Improving radar performance by providing a narrow, steerable beam in the vertical plane is an attractive approach, since better path assessment and consequent range measurement can be made. It should be remembered that the vertical launch angle required to get from the radar to the target varies with time (see Appendix E), and some "adaptive" techniques must be used with a narrow vertical beam to obtain the desired illumination. This area is considered most productive for radar-performance improvement, and a 1 to 2-degree beamwidth is suggested as a possible goal.

5. The total radiated power can be increased and commensurate performance increased as long as the receiver-signal processor can handle the big signals. If all possible measures have been taken to reduce clutter, two megawatts average power might be used. If each item is pushed toward the limits that have been suggested, a radar performance between 20 and 40 db better than the $PG^2T\sigma$ = 137 db indicated in Table 1 could be achieved, and this is the sort of improvement required to attain high reliability at long ranges. Figure 20 shows performance during a SSN 10 summer at 1800 naut mi parametric in $PG^2T\sigma$. At $PG^2T\sigma$ = 163 db the 2E modes have started to make a contribution, and thus there is confidence that a radar should work as well as indicated even though sporadic E has been neglected. Since this order of improvement is required only for the longer distances, it is needed only at the higher frequencies — say above 10 Mc.



a. A white dot indicates that either interference or noise exists in the indicated 5-kc channel with a level above -127 dbw. Studies of this type support the noise-frequency complement model used in the report; however, the measurements were made on the east coast of the USA, and their universal applicability can be questioned.



b. This occupancy study is as that of Fig. 19a, except that a light dot indicates interference or noise larger than -117 dbw in the 5-kc channel

Fig. 19 - Pattern of channel occupancy from 13 to 18 Mc in 5-kc intervals

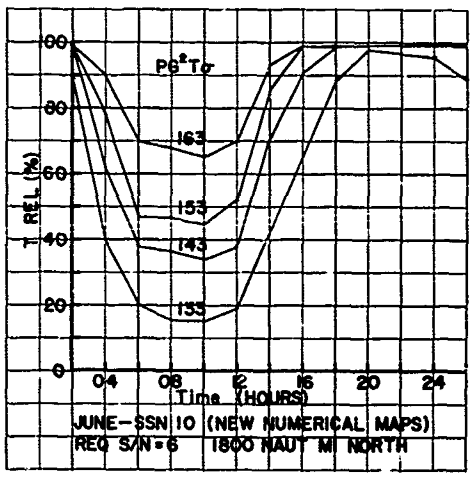


Fig. 20 - Diurnal plots of Total Reliability at 1800-naut-mi range for the worst season and a low SSN. If $PG^2T\sigma$ is made larger than 163 db, a high-reliability system can be achieved.

CONCLUSIONS

Methods have been developed to provide meaningful performance predictions, and the methods are adequate to set design criteria for a particular desired mission. The $PG^2T\sigma$ = 137 db product assumed for most of the analysis described in this report is, for example, a radar that could be intended to keep track of transatlantic aircraft; appreciable outage times at the longer ranges could be accepted; and a single transmitter-receiver could handle the task, since there is time for scanning. This same radar could be used for SLBM detection, but would be highly reliable out to 1000 or 1200 naut mi only, and of course would require multiple transmitter-receivers if a large area coverage is desired. A radar to provide high reliability coverage, for SLBM detection out to 2000 naut mi, could be designed and realized.

REFERENCES

1. Ostrow, S.M., "Handbook for CRPL Ionospheric Predictions Based on Numerical Methods of Mapping," National Bureau of Standards Handbook 90 (Unclassified), U.S. Dept. of Commerce, Dec. 21, 1962

2. Lucas, D.L., and Haydon, G.W., "Predicting Statistical Performance Indexes for High Frequency Ionospheric Telecommunication Systems," ESSA Technical Report 1ER-1-ITSA-1 (Unclassified), 1966

3. "World Distribution and Characteristics of Atmospheric Radio Noise," International Radio Consultative Committee (CCIR), Report 322 (Unclassified), International Telecommunication Union, Geneva, 1964

4. Headrick, J.M., Headrick, W.C., Ward, E.W., and Ahearn, J.L., "Spectrum and Amplitude of Earth Backscatter at HF," Proceedings of the ARPA Meeting (Secret Report, Unclassified Title), June 1-2, 1966

5. Headrick, J.M., Zettle, E.N., Ahearn, J.L., Tesauro, C.B., and Headrick, W.C., "Wave Interference and Focusing Effects with Sky-Wave Radar," Proceedings of the ARPA Meeting (Secret Report, Unclassified Title), Oct. 21-22, 1964

6. Ahearn, J.L., Headrick, W.C., Headrick, J.M., Tesauro, C.B., and Zettle, E.N., "Extended-Range Aircraft Tracking," NRL Report 6272 (Secret Report, Unclassified Title), May 12, 1965

7. Davis, J.R., Thomason, J.F., Hudnall, J.M., Boyd, F.E., and Utley, F.H., "The Spectral Characteristics and Temporal Behavior of HF Radar Echoes from Over-the-Horizon Aircraft Targets," NRL Report 6371 (Secret Report, Unclassified Title), Nov. 18, 1965

8. Headrick, W.C., and Ward, E.W., "High Frequency Channel Occupancy," Unofficial NRL Report with limited distribution (Unclassified), Apr. 14, 1966

9. Scott, T.D., and Tornatore, H.G., "Measurements of HF Spectrum Noise," Proceedings of the ARPA Meeting (Secret Report, Unclassified Title), July 7-8, 1965

10. Tveten, L.H., Melanson, L.L., and Moler, H.G., "High Frequency Backscatter Studies," National Bureau of Standards Report 8425 (Unclassified), Aug. 6, 1964

11. Headrick, J.M., Headrick, W.C., Ahearn, J.L., and Ward, E.W., "Earth Backscatter Character at HF," Proceedings of the ARPA Meeting (Secret Report, Unclassified Title), July 7-8, 1965

12. von Handel, P., "On HF Antennae Radiating at Very Low Elevation Angles," Institute for Defense Analyses Research Paper P-256 (Secret Report, Unclassified Title), Apr. 1966

13. Hayden, E.C., "The Wullenweber Antenna Array and Limitations to Passive Radiolocation Accuracy," Proceedings of the ARPA Meeting (Secret Proceedings, Unclassified Report), June 1-2, 1966

APPENDIX A

PREDICTION EXPLANATION AND SET OF TABLES

The problem will be briefly stated. The predictions were computed for June, March, and December, sunspot numbers 10, 50, and 100, using the following parameters:

a. Height of target (0 km)

b. Distance to target (500, 1000, and 1800 naut mi)

c. Gain of antenna (25 db)

d. Target radar area, SIGMA (1000 square meters). This area was a computational convenience to go with the noise tabulation, which was in power in a 1-cps band. The specified parameter in fact is the (radar area) (integration time) product, which would be 1000 m^2 sec.

e. 3 Mc man-made noise (-148 dbw used as a threshold)

f. Required signal-to-noise ratio (6 db)

g. Power (200 kw)

h. Minimum acceptable angle of takeoff and arrival (zero degree).

A description of the body of the printout follows:

1. MUF: Monthly median Maximum Usable Frequency

2. MODE: The mode contributing most to the overall probability that at least one sky-wave path exists

3. ANGLE: The average takeoff and arrival angle associated with the above mode

4. PROB.: The overall probability that at least one mode is present to produce the quasi-minimum loss for the circuit

5. DELAY: The one-way time delay of the path for the above mode expressed as tenths of milliseconds

6. NOISE: The predominant noise (atmospheric, threshold, or cosmic) (db $<$1 watt in a 1-cps bandwidth)

7. FS.LOSS: The free-space loss between isotropic radiators (two ways)

8. P.LOSS: The propagation losses two ways (ionospheric quasi-minimum and ground loss)

9. S/N. .DB: The received signal power in the occupied bandwidth relative to the noise in a 1-cps bandwidth

10. S/N..PROB: The probability that the available signal-to-noise exceeds the required signal-to-noise considering only the fluctuation of the signal and noise (ionospheric probability of support not included)

11. T.REL: The total combined reliability of the frequency complement.

One set of computation results is shown in the following tables, those for $PG^2T\sigma = 133$ db and a required output signal-to-noise ratio of 6 db.

An approximate manual solution for one hour and distance will be given. The relation used is

$$\left[\frac{s}{n}\right] = \frac{PG^2T\sigma\lambda^2}{NL(4\pi)^3 R^4} .$$

The computations were for $\sigma = 1000$ and $T = 1$; however, any $T\sigma = 1000$ is valid, and the examples in the body of the report can be taken as $\sigma = 100$ m^2 and $T = 10$ sec, since 100 m^2 is an appropriate estimate of a missile skin radar area and ten-second signal-processing time can frequently be effective. Since the free-space spreading loss as given in the tables is FS.LOSS = $(4\pi R/\lambda)^4$, that is, the two-way spreading loss between two isotropes, the radar equation will be rearranged:

$$\left[\frac{s}{n}\right] = \frac{PG^2T\sigma}{NL} \times \left(\frac{\lambda}{4\pi R}\right)^4 \times \frac{4\pi}{\lambda^2}$$

or using db

$$\left[\frac{s}{n}\right]_{db} = 10 \log P + 20 \log G + 10 \log \sigma T - 10 \log N - 10 \log L - FS.LOSS - 10 \log \frac{\lambda^2}{4\pi} .$$

The specified parameters set

$$10 \log P = 53$$
$$20 \log G = 50$$
$$10 \log \sigma T = 30.$$

Consider the case for June, SSN = 100, 1800 naut mi, and 16 hours at the MUF. The appropriate block from the computer printout is reproduced on following page.

35	JUN		SSN = 100		36.018
	TO		Azimuths		N.Miles
			180.0 360.0		1800.9

Sigma = 1000 Sq. Meters Ant = 25 db
Off Azimuth 0 deg. Min. Angle = -0 Deg. Off Azimuth 0 Deg.

PWR = 200.00 kw 3 Mc/s Man. Noise = -148 dbw Req. S/N = 6 db

Operating Frequencies

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
16	20.3														
	1F	3F	3F	2F	2F	2X	2F	1F	1F	1F	1F	1F	-	-	Mode
	4	23	22	15	14	8	14	2	2	2	3	3	-	-	Angle
	50	99	99	99	99	99	87	99	93	79	38	7	-	-	Prob.
	116	127	125	120	119	115	120	115	115	115	116	116	-	-	Delay
	171	153	154	155	157	158	161	165	168	169	171	173	-	-	Noise
	258	239	241	243	245	246	250	252	254	256	259	261	-	-	FS.Loss
	6	88	74	46	40	36	28	12	10	8	6	4	-	-	P. Loss
	14	-75	-63	-34	-27	-22	-13	5	10	12	14	16	-	-	S/N. .DB
	93	0	0	0	0	0	0	44	78	89	94	97	-	-	S/N. .Prob.
														84 =	T. Rel.

The quantity $-10 \log N = -171$ is taken from the above printout. As a matter of interest this value happened to be the median noise level set by specifying a rural noise threshold $10 \log L = 6 + 14$. The 6 is taken from the printout and is the quasi-minimum loss plus ground-reflection loss when appropriate. The 14 is the excess system loss which, though not printed out in the table, was used in the computations and came from Lucas and Haydon,* Table C. 12. This excess system loss is the factor that randomly varies, giving the day-to-day fluctuating signal description. Its median value for the problem here under study was approximately 14 db.

$$\text{FS. LOSS} = 258 \text{ db from the table}$$

$$10 \log \frac{\lambda^2}{4\pi} \approx 12 \text{ at } 20.3 \text{ Mc}$$

So: $[s/n]_{db} = 53 + 50 + 30 + 171 - 6 - 14 - 258 - 12 = 14$ db. This is the value that the computer printed out in the table.

An example of determining Total Reliability (T.REL) or percent time of effectiveness will be given for the same time block that the above output signal-to-noise ratio was computed. By inspection the highest best frequency reliability of the complement is at 16 Mc, and the reliability at that frequency can be computed

$$R_1 = (\text{PROB})(S/N \text{ PROB})$$
$$= (0.93)(0.78) = 0.73.$$

*D. L. Lucas and G. W. Haydon, "Predicting Statistical Performance Indexes for High Frequency Ionospheric Telecommunication Systems," Table C. 12, ESSA Technical Report IER-1-ITSA-1 (Unclassified), 1966.

Another reliability is computed selecting the best case from frequencies more than 15 percent above that of R_1. This turns out to be at 21 Mc.

$$R_2 = (0.38)(0.94) = 0.36.$$

Similarly, a reliability is computed for the best case among frequencies at least 15 percent below that of R_1. This is for 12 Mc and gives

$$R_3 = (0.87)(0.00) = 0.00.$$

It has been assumed that these reliabilities from frequencies 15 percent or more apart are independent, thus

$$\begin{aligned} T.REL &= R_1 + R_2 + R_3 - R_1R_2 - R_2R_3 - R_3R_1 + R_1R_2R_3 \\ &= 0.73 + 0.36 + 0.00 - 0.26 - 0.0 - 0.0 + 0.0 \\ &= 0.83 \text{ or } 83 \text{ percent.} \end{aligned}$$

This compares with the computer printout of 84 percent.

The computer results for SSN = 10, 50, and 100 at ranges of 500, 1000, and 1800 naut mi follow.

27 JUN SSN= 10. 36.005
TO AZIMUTHS N.MILES
359.9 499.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	6.7														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	31	28	31	31	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	80	40	15	-	-	-	-	-	-	-	-	-	-	PROB.
	38	36	38	38	-	-	-	-	-	-	-	-	-	-	DELAY
	157	156	158	159	-	-	-	-	-	-	-	-	-	-	NOISE
	219	217	220	223	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	6	4	4	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	33	35	36	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														88	=T.REL.
4	8.7														
	1F	1E	1E	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	28	12	13	26	29	28	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	70	41	14	-	-	-	-	-	-	-	-	PROB.
	36	32	32	36	37	37	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	223	217	219	222	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	12	22	18	14	10	8	-	-	-	-	-	-	-	-	P. LOSS
	29	17	23	27	31	33	-	-	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	9.4														
	1F	1E	1E	1E	1E	1F	-	-	-	-	-	-	-	-	MODE
	24	12	12	13	14	26	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	33	-	-	-	-	-	-	-	-	PROB.
	35	32	32	32	32	36	-	-	-	-	-	-	-	-	DELAY
	161	156	153	159	161	162	-	-	-	-	-	-	-	-	NOISE
	224	215	219	221	223	225	-	-	-	-	-	-	-	-	FS.LOSS
	18	68	30	26	20	16	-	-	-	-	-	-	-	-	P. LOSS
	23	-24	10	15	21	25	-	-	-	-	-	-	-	-	S/N..DB
	99	0	78	96	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	10.3														
	1E	1E	1E	1E	1E	1E	-	-	-	-	-	-	-	-	MODE
	15	12	12	12	13	14	-	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	226	220	218	221	223	225	-	-	-	-	-	-	-	-	FS.LOSS
	22	80	66	32	26	22	-	-	-	-	-	-	-	-	P. LOSS
	21	-43	-23	9	16	20	-	-	-	-	-	-	-	-	S/N..DB
	99	0	0	76	97	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	10.4														
	1E	1E	1E	1E	1E	1E	-	-	-	-	-	-	-	-	MODE
	15	12	12	12	13	14	-	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	-	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	225	222	218	222	224	225	-	-	-	-	-	-	-	-	FS.LOSS
	30	80	68	32	26	22	-	-	-	-	-	-	-	-	P. LOSS
	13	-43	-25	9	16	20	-	-	-	-	-	-	-	-	S/N..DB
	90	0	0	76	97	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	9.7														
	1E	1E	1E	1E	1E	-	-	-	-	-	-	-	-	-	MODE
	15	12	12	13	13	-	-	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	-	-	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	-	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	-	-	-	-	-	-	-	-	-	NOISE
	225	222	220	222	224	-	-	-	-	-	-	-	-	-	FS.LOSS
	18	68	32	26	20	-	-	-	-	-	-	-	-	-	P. LOSS
	24	-32	9	15	21	-	-	-	-	-	-	-	-	-	S/N..DB
	99	0	73	96	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	8.4														
	1E	1E	1E	1E	1F	-	-	-	-	-	-	-	-	-	MODE
	15	12	13	14	28	-	-	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	21	-	-	-	-	-	-	-	-	-	PROB.
	33	32	32	32	37	-	-	-	-	-	-	-	-	-	DELAY
	159	156	158	159	160	-	-	-	-	-	-	-	-	-	NOISE
	223	217	219	222	224	-	-	-	-	-	-	-	-	-	FS.LOSS
	16	28	22	16	14	-	-	-	-	-	-	-	-	-	P. LOSS
	25	13	19	24	27	-	-	-	-	-	-	-	-	-	S/N..DB
	99	91	99	99	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	9.9														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	28	23	23	23	25	28	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	95	77	46	-	-	-	-	-	-	-	-	PROB.
	36	35	35	35	35	37	-	-	-	-	-	-	-	-	DELAY
	158	153	154	155	157	158	-	-	-	-	-	-	-	-	NOISE
	226	216	219	221	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	4	-	-	-	-	-	-	-	-	P. LOSS
	33	24	27	29	32	33	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

		OPERATING FREQUENCIES													
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	11.0														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	29	22	22	23	24	25	29	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	94	77	22	-	-	-	-	-	-	-	PROB.
	37	34	34	35	35	36	37	-	-	-	-	-	-	-	DELAY
	161	151	153	155	157	159	163	-	-	-	-	-	-	-	NOISE
	228	216	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	2	-	-	-	-	-	-	-	P. LOSS
	38	30	32	34	35	37	39	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	97	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	9.1														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	30	23	24	26	29	30	-	-	-	-	-	-	-	-	ANGLE
	50	98	92	78	54	24	-	-	-	-	-	-	-	-	PROB.
	37	35	35	36	37	37	-	-	-	-	-	-	-	-	DELAY
	158	150	152	155	157	160	-	-	-	-	-	-	-	-	NOISE
	225	216	219	222	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	-	-	-	-	-	-	-	-	P. LOSS
	36	29	31	33	35	37	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	7.6														
	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	MODE
	31	26	28	31	31	-	-	-	-	-	-	-	-	-	ANGLE
	50	90	69	35	8	-	-	-	-	-	-	-	-	-	PROB.
	38	36	36	38	38	-	-	-	-	-	-	-	-	-	DELAY
	154	150	153	156	158	-	-	-	-	-	-	-	-	-	NOISE
	222	217	220	223	225	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	6	4	2	2	-	-	-	-	-	-	-	-	-	P. LOSS
	32	29	32	34	35	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
24	6.7														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	32	28	32	32	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	81	41	16	-	-	-	-	-	-	-	-	-	-	PROB.
	38	37	38	38	-	-	-	-	-	-	-	-	-	-	DELAY
	154	152	154	157	-	-	-	-	-	-	-	-	-	-	NOISE
	220	217	221	223	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	32	31	32	35	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														89	=T.REL.

```
       31           JUN              SSN=  10.                   36.01C
                    TO                               AZIMUTHS       N.MILES
                                                        359.9       1000.3
SIGMA= 1000 SQ. METERS                                            ANT= 25DB
OFF AZIMUTH    0 DEG.      MIN. ANGLE= -0 DEG.     OFF AZIMUTH    0 DEG.
PWR=200.00KW          3 MC/S MAN. NOISE = -148 DBW        REQ.S/N=  6DB
                              OPERATING FREQUENCIES
```

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	10.6														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	14	13	12	11	12	13	14	-	-	-	-	-	-	-	ANGLE
	50	99	99	98	91	70	21	-	-	-	-	-	-	-	PROB.
	67	66	66	66	66	66	67	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	237	227	230	232	234	236	240	-	-	-	-	-	-	-	FS.LOSS
	6	14	12	10	8	6	4	-	-	-	-	-	-	-	P. LOSS
	26	15	19	21	24	25	27	-	-	-	-	-	-	-	S/N..DB
	99	96	98	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	13.4														
	1F	1E	1E	1E	1E	1E	1F	1F	-	-	-	-	-	-	MODE
	12	3	3	3	3	3	11	12	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	77	35	-	-	-	-	-	-	PROB.
	66	63	63	63	63	63	65	66	-	-	-	-	-	-	DELAY
	166	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	241	227	229	232	234	236	239	242	-	-	-	-	-	-	FS.LOSS
	10	60	46	36	30	18	12	8	-	-	-	-	-	-	P. LOSS
	23	-28	-14	-4	2	14	19	23	-	-	-	-	-	-	S/N..DB
	99	0	0	9	25	94	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	14.5														
	1F	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	-	MODE
	11	3	3	3	3	3	3	4	11	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	18	-	-	-	-	-	PROB.
	65	63	63	63	63	63	63	63	65	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	242	226	231	232	234	235	239	242	244	-	-	-	-	-	FS.LOSS
	14	98	72	60	48	40	20	16	12	-	-	-	-	-	P. LOSS
	18	-66	-43	-28	-16	-7	11	16	21	-	-	-	-	-	S/N..DB
	99	0	0	0	0	4	86	97	99	-	-	-	-	-	S/N..PROB.
														98	=T.REL.
8	15.4														
	1E	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	-	MODE
	4	3	3	3	3	3	3	4	9	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	13	-	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	65	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	243	226	229	232	234	235	239	242	244	-	-	-	-	-	FS.LOSS
	18	122	94	76	62	52	36	22	16	-	-	-	-	-	P. LOSS
	15	-91	-63	-44	-29	-18	-3	11	17	-	-	-	-	-	S/N..DB
	96	0	0	0	0	0	12	85	98	-	-	-	-	-	S/N..PROB.
														96	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	15.6														
	1E	1E	1E	1E	1E	1E	1E	1E	-	-	-	-	-	-	MODE
	4	3	3	3	3	3	3	4	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	-	-	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	-	-	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	244	226	229	234	234	235	239	242	-	-	-	-	-	-	FS.LOSS
	18	126	98	74	64	52	26	22	-	-	-	-	-	-	P. LOSS
	16	-95	-66	-45	-31	-20	6	11	-	-	-	-	-	-	S/N..DB
	97	0	0	0	0	0	56	85	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.
12	14.6														
	1E	1E	1E	1F	1E	1E	1E	1E	-	-	-	-	-	-	[illegible]
	4	3	3	3	3	3	3	4	-	-	-	-	-	-	ANG[illegible]
	99	99	99	99	99	99	99	99	-	-	-	-	-	-	PR[illegible].
	63	63	63	63	63	63	63	63	-	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	243	226	232	234	234	235	239	242	-	-	-	-	-	-	FS.LOSS
	16	108	76	62	54	44	22	16	-	-	-	-	-	-	P. LOSS
	17	-76	-46	-33	-21	-12	9	15	-	-	-	-	-	-	S/N..DB
	98	0	0	0	0	1	76	96	-	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
14	12.7														
	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	-	-	MODE
	4	3	3	3	3	3	4	12	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	7	-	-	-	-	-	-	PROB.
	63	63	63	63	63	63	63	66	-	-	-	-	-	-	DELAY
	164	156	158	159	160	161	163	165	-	-	-	-	-	-	NOISE
	240	229	229	232	234	236	239	242	-	-	-	-	-	-	FS.LOSS
	14	66	56	44	36	20	14	12	-	-	-	-	-	-	P. LOSS
	18	-38	-24	-13	-4	10	16	20	-	-	-	-	-	-	S/N..DB
	99	0	0	2	11	76	97	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	14.5														
	1F	2F	1E	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	12	23	3	11	10	10	10	11	12	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	92	61	19	-	-	-	-	-	PROB.
	66	70	63	65	65	65	65	65	66	-	-	-	-	-	DELAY
	166	153	154	155	157	158	161	165	168	-	-	-	-	-	NOISE
	243	227	229	232	234	236	239	242	244	-	-	-	-	-	FS.LOSS
	4	34	26	14	12	10	8	6	4	-	-	-	-	-	P. LOSS
	27	-5	1	12	15	17	21	26	29	-	-	-	-	-	S/N..DB
	99	9	26	85	93	98	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	16.8														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	12	8	8	8	8	9	9	10	11	12	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	91	66	28	-	-	-	-	PROB.
	66	64	64	64	64	64	65	65	65	66	-	-	-	-	DELAY
	168	151	153	155	157	159	163	166	168	169	-	-	-	-	NOISE
	245	227	230	232	234	236	239	242	244	246	-	-	-	-	FS.LOSS
	2	10	8	6	6	4	4	2	2	2	-	-	-	-	P. LOSS
	31	14	17	20	22	24	28	30	31	32	-	-	-	-	S/N..DB
	99	94	99	99	99	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	14.6														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	13	9	9	9	9	9	10	12	13	-	-	-	-	-	ANGLE
	50	99	99	99	98	95	82	58	23	-	-	-	-	-	PROB.
	66	64	65	65	65	65	65	66	66	-	-	-	-	-	DELAY
	167	150	152	155	157	160	164	166	168	-	-	-	-	-	NOISE
	243	227	230	232	234	236	239	242	244	-	-	-	-	-	FS.LOSS
	2	10	8	6	6	4	2	2	2	-	-	-	-	-	P. LOSS
	31	13	16	20	22	25	29	30	31	-	-	-	-	-	S/N..DB
	99	95	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	11.6														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	14	10	10	10	11	11	14	14	-	-	-	-	-	-	ANGLE
	50	99	98	95	88	76	41	6	-	-	-	-	-	-	PROB.
	67	65	65	65	65	66	67	67	-	-	-	-	-	-	DELAY
	164	150	153	156	158	161	164	166	-	-	-	-	-	-	NOISE
	239	227	230	232	234	236	240	242	-	-	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	-	-	-	-	-	-	P. LOSS
	29	14	18	21	23	26	29	30	-	-	-	-	-	-	S/N..DB
	99	96	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	10.1														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	14	10	11	11	12	14	14	-	-	-	-	-	-	-	ANGLE
	50	99	99	96	82	52	11	-	-	-	-	-	-	-	PROB.
	67	65	65	65	66	67	67	-	-	-	-	-	-	-	DELAY
	162	152	154	157	160	162	164	-	-	-	-	-	-	-	NOISE
	237	227	230	232	234	236	240	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	2	-	-	-	-	-	-	-	P. LOSS
	27	16	19	22	26	27	29	-	-	-	-	-	-	-	S/N. DB
	99	97	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

35 JUN SSN= 10. 36.018

TO AZIMUTHS N.MILES

360.0 1800.9

SIGMA= 1000 SQ. METERS ANT= 25DB

OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.

PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	14.2														
	1F	2F	2F	2X	2F	1F	1F	1F	1F	-	-	-	-	-	MODE
	3	15	14	8	14	2	2	3	3	-	-	-	-	-	ANGLE
	50	99	99	99	81	99	91	54	21	-	-	-	-	-	PROB.
	116	120	119	115	120	115	115	116	116	-	-	-	-	-	DELAY
	166	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	252	238	240	243	245	246	249	252	254	-	-	-	-	-	FS.LOSS
	6	42	36	30	26	12	8	6	6	-	-	-	-	-	P. LOSS
	14	-24	-17	-12	-7	7	11	14	16	-	-	-	-	-	S/N..DB
	92	0	0	1	4	60	82	91	95	-	-	-	-	-	S/N..PROB.
														95	=T.REL.
4	16.1														
	1F	2E	2E	2E	2E	2E	2F	1F	1F	1F	-	-	-	-	MODE
	3	4	4	4	4	5	15	2	3	2	-	-	-	-	ANGLE
	50	99	99	99	99	99	27	83	52	16	-	-	-	-	PROB.
	116	113	113	113	114	114	120	115	116	115	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	254	237	241	242	245	246	250	252	254	256	-	-	-	-	FS.LOSS
	10	118	86	74	46	40	32	14	10	8	-	-	-	-	P. LOSS
	10	-100	-67	-55	-27	-21	-11	6	10	12	-	-	-	-	S/N..DB
	79	0	0	0	0	0	1	55	79	89	-	-	-	-	S/N..PROB.
														55	=T.REL.
6	16.9														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	-	-	-	-	MODE
	1	4	4	4	4	4	5	13	2	1	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	6	65	29	-	-	-	-	PROB.
	115	113	113	113	113	114	114	119	115	115	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	255	237	239	243	245	246	250	252	254	256	-	-	-	-	FS.LOSS
	16	182	142	102	86	78	44	36	16	14	-	-	-	-	P. LOSS
	6	-163	-122	-83	-68	-57	-24	-15	4	7	-	-	-	-	S/N..DB
	50	0	0	0	0	0	0	0	38	63	-	-	-	-	S/N..PROB.
														25	=T.REL.
8	17.1														
	1F	2E	2E	2E	2E	2E	2E	2E	-	1F	-	-	-	-	MODE
	0	4	4	4	4	4	5	5	-	0	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	-	34	-	-	-	-	PROB.
	114	113	113	113	113	113	114	114	-	114	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	-	169	-	-	-	-	NOISE
	255	237	239	242	245	247	249	252	-	256	-	-	-	-	FS.LOSS
	18	224	174	138	106	92	56	44	-	18	-	-	-	-	P. LOSS
	4	-203	-153	-118	-85	-72	-34	-22	-	5	-	-	-	-	S/N..DB
	37	0	0	0	0	0	0	0	-	49	-	-	-	-	S/N..PROB.
														19	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	14.5														
	2E	2E	2E	2E	2E	2E	2E	2E	-	1F	-	-	-	-	MODE
	6	4	4	4	4	4	5	5	-	1	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	-	75	-	-	-	-	PROB.
	114	113	113	113	113	113	114	114	-	115	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	-	163	-	-	-	-	NOISE
	252	237	239	244	245	247	250	252	-	256	-	-	-	-	FS.LOSS
	50	230	178	118	104	92	54	44	-	18	-	-	-	-	P. LOSS
	-28	-211	-159	-99	-86	-72	-35	-23	-	4	-	-	-	-	S/N..DB
	0	0	0	0	0	0	0	0	-	42	-	-	-	-	S/N..PROB.
														11	=T.REL.
12	16.2														
	1F	2E	2E	2E	2E	2E	2E	-	1F	1F	-	-	-	-	MODE
	2	4	4	4	4	4	5	-	2	2	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	-	54	15	-	-	-	-	PROB.
	115	113	113	113	113	114	114	-	115	115	-	-	-	-	DELAY
	168	156	158	159	161	162	164	-	168	169	-	-	-	-	NOISE
	254	237	239	244	246	247	250	-	254	256	-	-	-	-	FS.LOSS
	18	200	154	106	90	58	48	-	18	16	-	-	-	-	P. LOSS
	3	-180	-135	-87	-72	-40	-27	-	2	6	-	-	-	-	S/N..DB
	33	0	0	0	0	0	0	-	26	56	-	-	-	-	S/N..PROB.
														17	=T.REL.
14	16.0														
	1F	2E	2E	2E	2E	2E	2E	1F	1F	1F	-	-	-	-	MODE
	2	4	4	4	4	5	5	3	3	2	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	86	50	13	-	-	-	-	PROB.
	115	113	113	113	114	114	114	116	116	115	-	-	-	-	DELAY
	168	156	158	159	160	161	163	165	168	169	-	-	-	-	NOISE
	254	237	241	244	245	247	250	252	254	256	-	-	-	-	FS.LOSS
	14	140	96	82	52	46	36	16	12	10	-	-	-	-	P. LOSS
	9	-121	-77	-63	-32	-26	-16	4	9	12	-	-	-	-	S/N..DB
	73	0	0	0	0	0	0	40	73	89	-	-	-	-	S/N..PROB.
														37	=T.REL.
16	17.2														
	1F	3F	2E	2F	2X	2F	1F	1F	1F	1F	-	-	-	-	MODE
	2	21	4	13	8	12	1	1	2	2	-	-	-	-	ANGLE
	50	99	99	99	99	94	99	93	71	34	-	-	-	-	PROB.
	115	124	114	118	115	118	115	115	115	115	-	-	-	-	DELAY
	169	153	154	155	157	158	161	165	168	169	-	-	-	-	NOISE
	255	237	239	243	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	6	76	60	38	34	30	12	8	6	6	-	-	-	-	P. LOSS
	13	-62	-46	-26	-20	-16	3	8	12	13	-	-	-	-	S/N..DB
	90	0	0	0	0	0	33	69	87	92	-	-	-	-	S/N..PROB.
														76	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	19.5														
	1F	2F	1F	1F	2F	2F	1F	1F	1F	1F	1F	-	-	-	MODE
	2	11	1	0	11	11	0	0	1	1	2	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	92	72	25	-	-	-	PROB.
	115	117	114	114	117	117	114	114	114	115	115	-	-	-	DELAY
	170	151	153	155	157	159	163	166	168	169	171	-	-	-	NOISE
	257	237	240	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	2	26	10	8	18	16	4	4	2	2	2	-	-	-	P. LOSS
	17	-15	1	4	-3	-1	12	15	17	17	18	-	-	-	S/N..DB
	98	0	18	37	6	10	95	96	98	98	99	-	-	-	S/N..PROB.
														99	=T.REL.
20	18.0														
	1F	1F	1F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	2	0	0	11	0	0	0	1	1	2	2	-	-	-	ANGLE
	50	99	99	98	99	99	96	87	72	50	11	-	-	-	PROB.
	115	114	114	117	114	114	114	114	115	115	115	-	-	-	DELAY
	169	150	152	155	157	160	164	166	168	169	171	-	-	-	NOISE
	256	237	240	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	2	14	10	20	6	6	4	4	2	2	2	-	-	-	P. LOSS
	19	-1	2	-5	8	11	15	17	18	19	20	-	-	-	S/N..DB
	99	7	23	1	75	91	95	98	98	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
22	14.7														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	3	1	1	1	1	1	1	2	3	-	-	-	-	-	ANGLE
	50	99	99	99	98	95	82	59	25	-	-	-	-	-	PROB.
	116	114	114	114	114	115	115	115	116	-	-	-	-	-	DELAY
	167	150	153	156	158	161	164	166	168	-	-	-	-	-	NOISE
	253	237	240	242	244	246	249	252	254	-	-	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	-	-	-	-	-	P. LOSS
	18	-1	3	7	9	13	16	17	19	-	-	-	-	-	S/N..DB
	99	10	27	60	84	98	98	98	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	12.9														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	3	2	1	1	1	1	2	3	3	-	-	-	-	-	ANGLE
	50	99	99	99	99	97	71	28	6	-	-	-	-	-	PROB.
	116	115	115	115	115	115	115	116	116	-	-	-	-	-	DELAY
	165	152	154	157	160	162	164	166	168	-	-	-	-	-	NOISE
	250	237	240	242	244	246	249	252	254	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	4	2	-	-	-	-	-	P. LOSS
	16	0	4	8	11	14	15	17	19	-	-	-	-	-	S/N..DB
	97	14	40	70	88	94	96	98	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

27 JUN SSN= 50. 36.005
TO AZIMUTHS N.MILES
359.9 499.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	7.6														
	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	MODE
	32	28	30	33	33	-	-	-	-	-	-	-	-	-	ANGLE
	50	96	74	38	16	-	-	-	-	-	-	-	-	-	PROB.
	38	36	37	39	39	-	-	-	-	-	-	-	-	-	DELAY
	159	156	158	159	161	-	-	-	-	-	-	-	-	-	NOISE
	222	217	220	223	225	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	-	-	-	-	-	-	-	-	-	P. LOSS
	35	32	34	35	37	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	9.7														
	1F	1F	1E	1E	1F	1F	-	-	-	-	-	-	-	-	MODE
	29	27	13	14	27	30	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	67	40	-	-	-	-	-	-	-	-	PROB.
	37	36	32	33	36	37	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	226	217	219	222	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	10	26	20	16	12	10	-	-	-	-	-	-	-	-	P. LOSS
	31	15	21	25	29	31	-	-	-	-	-	-	-	-	S/N..DB
	99	96	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	10.3														
	1F	1E	1E	1E	1E	1F	1F	-	-	-	-	-	-	-	MODE
	26	12	12	12	13	26	28	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	57	11	-	-	-	-	-	-	-	PROB.
	36	32	32	32	32	36	36	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	226	215	219	221	224	226	229	-	-	-	-	-	-	-	FS.LOSS
	18	78	34	28	24	18	12	-	-	-	-	-	-	-	P. LOSS
	25	-34	7	12	19	23	29	-	-	-	-	-	-	-	S/N..DB
	99	0	59	90	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	10.9														
	1E	1E	1E	1E	1E	1E	-	-	-	-	-	-	-	-	MODE
	15	12	12	12	13	13	-	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	-	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	227	220	218	222	223	225	-	-	-	-	-	-	-	-	FS.LOSS
	20	90	76	36	30	24	-	-	-	-	-	-	-	-	P. LOSS
	22	-52	-33	6	12	18	-	-	-	-	-	-	-	-	S/N..DB
	99	0	0	57	88	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	11.1														
	1E	1E	1E	1E	1E	1E	-	-	-	-	-	-	-	-	MODE
	15	12	12	12	12	13	-	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	-	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	228	221	224	222	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	20	90	72	34	30	22	-	-	-	-	-	-	-	-	P. LOSS
	22	-53	-35	6	12	18	-	-	-	-	-	-	-	-	S/N..DB
	99	0	0	57	88	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	10.3														
	1E	1E	1E	1E	1E	1E	-	-	-	-	-	-	-	-	MODE
	15	12	12	12	13	14	-	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	227	222	220	222	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	18	76	36	30	24	18	-	-	-	-	-	-	-	-	P. LOSS
	23	-41	5	11	18	22	-	-	-	-	-	-	-	-	S/N..DB
	99	0	45	86	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	9.3														
	1F	1F	1E	1E	1F	1F	-	-	-	-	-	-	-	-	MODE
	29	28	12	13	28	30	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	60	26	-	-	-	-	-	-	-	-	PROB.
	37	37	32	32	37	37	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	160	161	-	-	-	-	-	-	-	-	NOISE
	225	217	219	222	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	14	30	24	20	16	12	-	-	-	-	-	-	-	-	P. LOSS
	26	9	16	21	25	28	-	-	-	-	-	-	-	-	S/N..DB
	99	73	97	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	10.5														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	29	24	24	24	25	27	30	-	-	-	-	-	-	-	ANGLE
	50	99	99	98	89	66	13	-	-	-	-	-	-	-	PROB.
	37	35	35	35	35	36	37	-	-	-	-	-	-	-	DELAY
	159	153	154	155	157	158	161	-	-	-	-	-	-	-	NOISE
	227	216	219	221	224	226	229	-	-	-	-	-	-	-	FS.LOSS
	4	14	12	8	8	6	4	-	-	-	-	-	-	-	P. LOSS
	33	23	26	28	31	32	35	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

		OPERATING FREQUENCIES													
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	11.1														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	30	23	24	24	25	27	30	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	95	80	25	-	-	-	-	-	-	-	PROB.
	38	35	35	35	36	36	38	-	-	-	-	-	-	-	DELAY
	161	151	153	155	157	159	163	-	-	-	-	-	-	-	NOISE
	228	216	219	221	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	2	-	-	-	-	-	-	-	P. LOSS
	37	30	32	34	35	36	39	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	97	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	9.6														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	32	25	26	27	29	32	-	-	-	-	-	-	-	-	ANGLE
	50	99	95	85	66	39	-	-	-	-	-	-	-	-	PROB.
	38	35	36	36	37	38	-	-	-	-	-	-	-	-	DELAY
	159	150	152	155	157	160	-	-	-	-	-	-	-	-	NOISE
	226	216	219	222	224	227	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	-	-	-	-	-	-	-	-	P. LOSS
	36	29	31	33	35	37	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	8.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	33	27	2[illegible]	31	33	33	-	-	-	-	-	-	-	-	ANGLE
	50	96	85	62	31	8	-	-	-	-	-	-	-	-	PROB.
	39	36	37	38	39	39	-	-	-	-	-	-	-	-	DELAY
	157	150	153	156	158	161	-	-	-	-	-	-	-	-	NOISE
	224	217	220	223	225	227	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	2	2	2	-	-	-	-	-	-	-	-	P. LOSS
	34	29	32	34	35	38	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	7.5														
	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	MODE
	34	29	31	34	34	-	-	-	-	-	-	-	-	-	ANGLE
	50	96	72	37	15	-	-	-	-	-	-	-	-	-	PROB.
	39	37	38	39	39	-	-	-	-	-	-	-	-	-	DELAY
	156	152	154	157	160	-	-	-	-	-	-	-	-	-	NOISE
	222	217	220	223	225	-	-	-	-	-	-	-	-	-	FS.LOSS
	2	4	4	2	2	-	-	-	-	-	-	-	-	-	P. LOSS
	34	31	32	34	37	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

31 JUN SSN= 5ʳ. 36.010
TO AZIMUTHS N.MILES
359.9 1000.3
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	11.8														
	1F	1E	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	15	3	12	12	12	13	15	15	-	-	-	-	-	-	ANGLE
	50	99	99	99	98	90	46	12	-	-	-	-	-	-	PROB.
	67	63	66	66	66	66	67	67	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	239	227	230	232	234	236	240	242	-	-	-	-	-	-	FS.LOSS
	4	26	12	10	8	6	4	4	-	-	-	-	-	-	P. LOSS
	27	5	17	20	23	24	27	28	-	-	-	-	-	-	S/N..DB
	99	46	97	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	14.6														
	1F	2F	1E	1E	1E	1E	1E	1F	1F	-	-	-	-	-	MODE
	13	27	3	3	3	3	4	13	14	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	61	20	-	-	-	-	-	PROB.
	66	72	63	63	63	63	63	66	66	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	243	229	229	232	234	236	239	242	245	-	-	-	-	-	FS.LOSS
	10	64	52	42	34	18	14	10	8	-	-	-	-	-	P. LOSS
	24	-35	-20	-10	-1	12	18	22	25	-	-	-	-	-	S/N..DB
	99	0	0	2	16	89	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	15.5														
	1F	1E	1E	1E	1E	1E	1E	1E	1F	1F	-	-	-	-	MODE
	12	3	3	3	3	3	3	4	12	12	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	39	8	-	-	-	-	PROB.
	66	63	63	63	63	63	63	63	66	66	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	244	226	232	232	234	235	239	242	244	246	-	-	-	-	FS.LOSS
	14	112	78	68	56	46	22	18	14	10	-	-	-	-	P. LOSS
	18	-80	-49	-37	-23	-13	9	14	20	22	-	-	-	-	S/N..DB
	99	0	0	0	0	1	76	94	99	99	-	-	-	-	S/N..PROB.
														96	=T.REL.
8	16.3														
	1E	1E	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	MODE
	4	3	3	3	3	3	3	3	4	11	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	99	7	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	63	65	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	245	226	229	234	234	235	239	242	244	246	-	-	-	-	FS.LOSS
	18	140	108	80	70	58	42	22	18	14	-	-	-	-	P. LOSS
	16	-109	-77	-51	-38	-26	-9	10	15	19	-	-	-	-	S/N..DB
	97	0	0	0	0	0	2	81	96	99	-	-	-	-	S/N..PROB.
														97	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	16.6														
	1E	1E	1E	1E	1E	1E	1E	1E	1E	-	-	-	-	-	MODE
	4	3	3	3	3	3	3	3	4	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	99	-	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	63	-	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	245	226	229	234	236	235	239	242	244	-	-	-	-	-	FS.LOSS
	16	146	112	80	68	60	44	22	18	-	-	-	-	-	P. LOSS
	16	-114	-80	-51	-37	-28	-10	10	15	-	-	-	-	-	S/N..DB
	98	0	0	0	0	0	2	81	96	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
12	15.4														
	1E	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	-	MODE
	4	3	3	3	3	3	3	4	13	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	7	-	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	66	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	244	226	232	234	237	235	239	242	244	-	-	-	-	-	FS.LOSS
	16	124	82	70	56	52	24	18	14	-	-	-	-	-	P. LOSS
	17	-92	-53	-40	-27	-18	8	14	19	-	-	-	-	-	S/N..DB
	98	0	0	0	0	0	70	94	99	-	-	-	-	-	S/N..PROB.
														98	=T.REL.
14	13.6														
	1F	2F	1E	1E	1E	1E	1E	1F	-	-	-	-	-	-	MODE
	13	29	3	3	3	3	4	14	-	-	-	-	-	-	ANGLE
	52	99	99	99	99	99	99	38	-	-	-	-	-	-	PROB.
	66	74	63	63	63	63	63	67	-	-	-	-	-	-	DELAY
	165	156	158	159	160	161	163	165	-	-	-	-	-	-	NOISE
	242	229	232	232	234	235	239	242	-	-	-	-	-	-	FS.LOSS
	12	72	62	50	42	34	16	12	-	-	-	-	-	-	P. LOSS
	18	-44	-32	-19	-10	-2	14	19	-	-	-	-	-	-	S/N..DB
	99	0	0	0	3	14	94	99	-	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
16	15.5														
	1F	2F	1E	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	13	24	3	12	11	10	10	11	13	13	-	-	-	-	ANGLE
	50	99	99	99	99	99	96	78	39	8	-	-	-	-	PROB.
	66	70	63	66	65	65	65	65	66	66	-	-	-	-	DELAY
	167	153	154	155	157	158	161	165	168	169	-	-	-	-	NOISE
	244	227	229	232	234	236	239	242	244	246	-	-	-	-	FS.LOSS
	4	38	30	16	14	12	8	6	4	4	-	-	-	-	P. LOSS
	28	-10	-1	10	13	16	20	25	29	29	-	-	-	-	S/N..DB
	99	3	18	77	88	97	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	16.9														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	14	9	9	9	9	9	10	11	12	14	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	92	67	30	-	-	-	-	PROB.
	66	65	65	65	65	65	65	65	66	66	-	-	-	-	DELAY
	169	151	153	155	157	159	163	166	168	169	-	-	-	-	NOISE
	245	227	230	232	234	236	239	242	244	247	-	-	-	-	FS.LOSS
	2	10	8	6	6	4	4	2	2	2	-	-	-	-	P. LOSS
	32	15	17	20	22	24	28	30	31	32	-	-	-	-	S/N..DB
	99	96	99	99	99	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	15.1														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	14	10	10	10	10	10	11	12	[illegible]	14	-	-	-	-	ANGLE
	50	99	99	99	98	96	85	64	32	7	-	-	-	-	PROB.
	67	65	65	65	65	65	65	66	67	67	-	-	-	-	DELAY
	167	150	152	155	157	160	164	166	168	169	-	-	-	-	NOISE
	244	227	230	232	234	236	239	242	245	247	-	-	-	-	FS.LOSS
	2	10	8	6	6	4	2	2	2	2	-	-	-	-	P. LOSS
	31	14	17	20	22	25	29	30	31	32	-	-	-	-	S/N..DB
	99	97	99	99	99	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	12.7														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	15	11	11	[illegible]	11	12	14	15	-	-	-	-	-	-	ANGLE
	50	99	99	97	93	86	61	22	-	-	-	-	-	-	PROB.
	67	65	65	65	[illegible]	66	66	67	-	-	-	-	-	-	DELAY
	165	150	153	156	158	161	164	166	-	-	-	-	-	-	NOISE
	241	227	230	232	234	236	240	242	-	-	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	-	-	-	-	-	-	P. LOSS
	30	14	18	21	23	26	29	30	-	-	-	-	-	-	S/N..DB
	99	96	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	11.2														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	16	11	11	12	12	13	16	16	-	-	-	-	-	-	ANGLE
	50	99	99	99	95	81	32	5	-	-	-	-	-	-	PROB.
	67	65	66	66	66	66	67	67	-	-	-	-	-	-	DELAY
	163	152	154	157	160	162	164	166	-	-	-	-	-	-	NOISE
	239	227	230	232	234	236	240	242	-	-	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	-	-	-	-	-	-	P. LOSS
	28	16	19	22	26	27	29	30	-	-	-	-	-	-	S/N..DB
	99	97	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

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      35           JUN                SSN=  50.                36.018
                    TO                              AZIMUTHS     N.MILES
                                                       360.0     1800.9
 SIGMA= 1000 SQ. METERS                                          ANT= 25DB
 OFF AZIMUTH   0 DEG.     MIN. ANGLE= -0 DEG.     OFF AZIMUTH   0 DEG.
 PWR=200.00KW         3 MC/S MAN. NOISE = - .48 DBW       REQ.S/N=  6DB
                              OPERATING FREQUENCIES
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GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	15.7														
	1F	3F	2F	2F	2X	1F	1F	1F	1F	1F	-	-	-	-	MODE
	4	23	15	14	8	3	2	3	3	3	-	-	-	-	ANGLE
	50	99	99	99	98	99	98	83	46	18	-	-	-	-	PROB.
	116	126	120	120	115	116	115	116	116	116	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	254	237	240	243	245	246	249	252	254	256	-	-	-	-	FS.LOSS
	6	64	38	34	28	14	10	8	6	4	-	-	-	-	P. LOSS
	15	-46	-20	-15	-9	6	10	13	15	16	-	-	-	-	S/N..DB
	92	0	0	0	2	54	78	89	93	95	-	-	-	-	S/N..PROB.
														98	=T.REL.
4	17.5														
	1F	2E	2E	2E	2L	2E	2F	1F	1F	1F	-	-	-	-	MODE
	3	4	4	4	4	5	15	3	3	3	-	-	-	-	ANGLE
	50	99	99	99	99	99	54	92	73	41	-	-	-	-	PROB.
	116	113	113	113	114	114	120	116	116	116	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	256	237	241	244	245	247	250	252	254	256	-	-	-	-	FS.LOSS
	10	136	92	80	50	44	34	16	12	10	-	-	-	-	P. LOSS
	11	-117	-75	-62	-31	-25	-14	5	9	11	-	-	-	-	S/N..DB
	84	0	0	0	0	0	0	48	73	85	-	-	-	-	S/N..PROB.
														54	=T.REL.
6	18.[illegible]														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	1F	-	-	-	MODE
	2	4	4	4	4	4	5	14	3	3	2	-	-	-	ANGLE
	50	99	99	99	99	99	99	14	80	52	9	-	-	-	PROB.
	115	113	113	113	113	113	114	120	116	116	115	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	256	237	239	244	246	248	250	252	254	256	259	-	-	-	FS.LOSS
	16	208	162	110	94	82	48	38	18	16	12	-	-	-	P. LOSS
	6	-189	-142	-92	-76	-63	-29	-18	2	6	10	-	-	-	S/N..DB
	56	0	0	0	0	0	0	0	25	56	80	-	-	-	S/N..PROB.
														35	=T.REL.
8	18.5														
	1F	2E	2E	2E	2E	2E	2E	2E	-	1F	1F	-	-	-	MODE
	1	4	4	4	4	4	4	5	-	3	1	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	-	58	14	-	-	-	PROB.
	115	113	113	113	113	113	114	114	-	116	115	-	-	-	DELAY
	170	156	158	159	161	162	164	166	-	169	171	-	-	-	NOISE
	257	237	239	242	246	247	250	252	-	256	259	-	-	-	FS.LOSS
	18	256	198	160	112	96	58	48	-	18	14	-	-	-	P. LOSS
	5	-236	-178	-138	-92	-76	-37	-25	-	3	8	-	-	-	S/N..DB
	44	0	0	0	0	0	0	0	-	34	69	-	-	-	S/N..PROB.
														28	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	18.1														
	1F	2E	2E	2E	2E	2E	2E	2E	-	1F	1F	-	-	-	MODE
	2	4	4	4	4	4	4	5	-	2	2	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	-	52	10	-	-	-	PROB.
	115	113	113	113	113	113	114	114	-	115	115	-	-	-	DELAY
	169	156	158	159	161	162	164	166	-	169	171	-	-	-	NOISE
	256	237	239	242	246	248	250	252	-	256	259	-	-	-	FS.LOSS
	20	264	204	164	112	98	58	48	-	20	14	-	-	-	P. LOSS
	1	-245	-185	-144	-93	-79	-38	-26	-	1	7	-	-	-	S/N..DB
	23	0	0	0	0	0	0	0	-	23	62	-	-	-	S/N..PROB.
														18	=T.REL.
12	17.6														
	1F	2E	2E	2E	2E	2E	2E	2E	-	1F	-	-	-	-	MODE
	2	4	4	4	4	4	5	5	-	2	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	-	42	-	-	-	-	PROB.
	115	113	113	113	113	113	114	114	-	115	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	-	169	-	-	-	-	NOISE
	256	237	239	244	246	248	250	253	-	256	-	-	-	-	FS.LOSS
	18	228	178	114	98	86	50	40	-	18	-	-	-	-	P. LOSS
	3	-209	-157	-97	-80	-67	-31	-20	-	4	-	-	-	-	S/N..DB
	33	0	0	0	0	0	0	0	-	42	-	-	-	-	S/N..PROB.
														18	=T.REL.
14	17.5														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	-	-	-	-	MODE
	3	4	4	4	4	4	5	16	3	3	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	7	77	40	-	-	-	-	PROB.
	116	113	113	113	113	114	114	121	116	116	-	-	-	-	DELAY
	169	156	158	159	160	161	163	165	168	169	-	-	-	-	NOISE
	256	237	241	244	246	247	250	253	254	256	-	-	-	-	FS.LOSS
	12	160	104	90	76	50	38	32	14	12	-	-	-	-	P. LOSS
	10	-141	-85	-71	-58	-31	-19	-11	7	10	-	-	-	-	S/N..DB
	79	0	0	0	0	0	0	1	60	80	-	-	-	-	S/N..PROB.
														46	=T.REL.
16	18.6														
	1F	3F	3F	2F	2F	2X	1F	1F	1F	1F	1F	-	-	-	MODE
	3	22	21	14	13	7	2	1	2	2	2	-	-	-	ANGLE
	50	99	99	99	99	99	99	98	87	61	14	-	-	-	PROB.
	116	125	124	119	119	115	115	115	115	115	115	-	-	-	DELAY
	170	153	154	155	157	158	161	165	168	169	171	-	-	-	NOISE
	257	238	239	243	245	246	249	252	254	256	259	-	-	-	FS.LOSS
	6	80	68	42	36	32	14	10	8	6	4	-	-	-	P. LOSS
	14	-68	-54	-30	-23	-19	1	7	11	13	15	-	-	-	S/N..DB
	93	0	0	0	0	0	21	61	83	92	96	-	-	-	S/N..PROB.
														82	=T.REL.

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
						OPERATING FREQUENCIES									
18	20.3														
	1F	2F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	MODE
	3	12	2	1	0	0	0	1	1	2	3	3	-	-	ANGLE
	50	99	99	99	99	99	99	99	95	81	38	6	-	-	PROB.
	116	118	115	114	114	114	114	114	115	115	116	116	-	-	DELAY
	171	151	153	155	157	159	163	166	168	169	171	173	-	-	NOISE
	258	237	240	242	244	246	249	252	254	256	259	261	-	-	FS.LOSS
	2	26	12	8	3	6	4	4	2	2	2	2	-	-	P. LOSS
	18	-16	0	3	6	8	12	15	16	17	18	19	-	-	S/N..DB
	99	0	14	29	53	71	95	96	97	98	99	99	-	-	S/N..PROB.
														99	=T.REL.
20	19.0														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	3	1	1	1	1	1	1	1	2	2	3	-	-	-	ANGLE
	50	99	99	99	99	99	97	91	79	61	21	-	-	-	PROB.
	116	115	114	114	114	114	114	115	115	115	116	-	-	-	DELAY
	170	150	152	155	157	160	164	166	168	169	171	-	-	-	NOISE
	257	237	240	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	2	-	-	-	P. LOSS
	19	-1	1	5	8	11	15	17	18	19	20	-	-	-	S/N..DB
	99	7	17	43	75	91	95	98	98	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
22	16.2														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	4	1	1	1	1	1	2	2	3	3	-	-	-	-	ANGLE
	50	99	99	99	99	98	91	76	53	20	-	-	-	-	PROB.
	116	115	115	115	115	115	115	115	116	116	-	-	-	-	DELAY
	168	150	153	156	158	161	164	166	168	169	-	-	-	-	NOISE
	254	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	-	-	-	-	P. LOSS
	19	-1	3	7	9	13	16	17	19	19	-	-	-	-	S/N..DB
	99	10	27	60	84	98	98	98	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	14.5														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	4	3	2	2	2	2	2	3	4	4	-	-	-	-	ANGLE
	50	99	99	99	99	99	93	62	25	6	-	-	-	-	PROB.
	116	116	115	115	115	115	115	116	116	116	-	-	-	-	DELAY
	167	152	154	157	160	162	164	166	168	169	-	-	-	-	NOISE
	253	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	-	-	-	-	P. LOSS
	18	0	4	8	11	14	15	17	19	19	-	-	-	-	S/N..DB
	99	14	40	70	88	94	96	98	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

27 JUN SSN= 100. 36.005
TO AZIMUTHS N.MILES
359.9 499.9
SIGMA= 1000 SQ. METERS ANY= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	8.6														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	35	29	30	32	35	35	-	-	-	-	-	-	-	-	ANGLE
	50	96	86	65	39	17	-	-	-	-	-	-	-	-	PROB.
	40	37	37	38	40	40	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	225	217	220	223	226	227	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	35	31	33	34	36	37	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	10.7														
	1F	1E	1E	1E	1F	1F	1F	-	-	-	-	-	-	-	MODE
	32	12	12	13	28	29	32	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	80	64	26	-	-	-	-	-	-	-	PROB.
	38	32	32	32	36	37	38	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	228	217	220	222	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	10	28	22	18	14	12	8	-	-	-	-	-	-	-	P. LOSS
	32	12	18	23	27	30	33	-	-	-	-	-	-	-	S/N..DB
	99	88	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	11.2														
	1F	1E	1E	1E	1E	1E	1F	1F	-	-	-	-	-	-	MODE
	29	12	12	12	13	14	30	30	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	34	8	-	-	-	-	-	-	PROB.
	37	32	32	32	32	32	37	37	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	228	221	218	222	224	226	230	232	-	-	-	-	-	-	FS.LOSS
	16	82	70	32	26	20	14	10	-	-	-	-	-	-	P. LOSS
	26	-44	-25	9	16	21	28	32	-	-	-	-	-	-	S/N..DB
	99	0	0	76	97	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	11.7														
	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	-	-	-	MODE
	15	12	12	12	12	13	28	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	26	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	37	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	229	221	224	220	224	226	229	-	-	-	-	-	-	-	FS.LOSS
	20	100	80	70	34	28	18	-	-	-	-	-	-	-	P. LOSS
	23	-63	-43	-27	9	14	23	-	-	-	-	-	-	-	S/N..DB
	99	0	0	0	73	94	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	11.9														
	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	-	-	-	MODE
	15	12	12	12	12	13	30	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	24	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	37	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	229	222	225	222	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	18	100	80	38	32	26	18	-	-	-	-	-	-	-	P. LOSS
	23	-64	-44	1	9	14	23	-	-	-	-	-	-	-	S/N..DB
	99	0	0	23	73	94	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	11.0														
	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	-	-	-	MODE
	15	12	12	12	12	13	32	-	-	-	-	-	-	-	ANGLE
	99	99	99	99	99	99	20	-	-	-	-	-	-	-	PROB.
	33	32	32	32	32	32	38	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	228	222	225	222	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	18	86	70	34	26	22	14	-	-	-	-	-	-	-	P. LOSS
	24	-50	-33	7	14	19	26	-	-	-	-	-	-	-	S/N..DB
	99	0	0	64	94	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	10.5														
	1F	1E	1E	1E	1E	1F	1F	-	-	-	-	-	-	-	MODE
	31	12	12	13	14	29	32	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	61	14	-	-	-	-	-	-	-	PROB.
	38	32	32	32	32	37	38	-	-	-	-	-	-	-	DELAY
	161	156	158	159	160	161	163	-	-	-	-	-	-	-	NOISE
	227	215	220	222	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	12	66	28	22	18	14	10	-	-	-	-	-	-	-	P. LOSS
	27	-22	13	18	22	26	30	-	-	-	-	-	-	-	S/N..DB
	99	0	91	97	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	11.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	31	25	25	25	26	27	31	-	-	-	-	-	-	-	ANGLE
	50	99	99	95	88	74	30	-	-	-	-	-	-	-	PROB.
	38	35	35	35	36	36	38	-	-	-	-	-	-	-	DELAY
	160	153	154	155	157	158	161	-	-	-	-	-	-	-	NOISE
	229	217	219	222	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	4	16	12	10	8	6	4	-	-	-	-	-	-	-	P. LOSS
	33	21	24	27	30	31	34	-	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	11.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	33	25	26	26	27	29	33	-	-	-	-	-	-	-	ANGLE
	50	99	99	95	87	73	30	-	-	-	-	-	-	-	PROB.
	39	35	36	36	36	37	39	-	-	-	-	-	-	-	DELAY
	161	151	153	155	157	159	163	-	-	-	-	-	-	-	NOISE
	229	217	219	222	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	2	-	-	-	-	-	-	-	P. LOSS
	37	30	32	33	35	36	38	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	98	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	10.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	34	27	28	29	30	33	34	-	-	-	-	-	-	-	ANGLE
	50	99	97	89	75	54	9	-	-	-	-	-	-	-	PROB.
	39	36	36	37	37	39	39	-	-	-	-	-	-	-	DELAY
	160	150	152	155	157	160	164	-	-	-	-	-	-	-	NOISE
	228	217	220	222	225	7	230	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	2	-	-	-	-	-	-	-	P. LOSS
	36	29	31	33	34	36	39	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	9.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	35	29	30	31	34	35	-	-	-	-	-	-	-	-	ANGLE
	50	98	93	80	59	30	-	-	-	-	-	-	-	-	PROB.
	40	37	37	38	39	40	-	-	-	-	-	-	-	-	DELAY
	159	150	153	156	158	161	-	-	-	-	-	-	-	-	NOISE
	226	217	220	223	225	228	-	-	-	-	-	-	-	-	FS.LOSS
	2	4	4	2	2	2	-	-	-	-	-	-	-	-	P. LOSS
	35	29	31	34	35	37	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	8.4														
	1F	1F	1F	1F	[illegible]	1F	-	-	-	-	-	-	-	-	MODE
	36	30	32	34	[illegible]	36	-	-	-	-	-	-	-	-	ANGLE
	50	95	84	6[illegible]	[illegible]	13	-	-	-	-	-	-	-	-	PROB.
	41	37	38	39	41	41	-	-	-	-	-	-	-	-	DELAY
	158	152	154	157	160	162	-	-	-	-	-	-	-	-	NOISE
	225	217	220	223	226	228	-	-	-	-	-	-	-	-	FS.LOSS
	2	4		2	2	2	-	-	-	-	-	-	-	-	P. LOSS
	35	31	32	34	36	38	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

```
         31            JUN              SSN= 10C.                 36.01C
                        TO                           AZIMUTHS       N.MILES
                                                        359.9       1000.3
SIGMA= 1000 SQ. METERS                                              ANT= 25DB
OFF AZIMUTH    0 DEG.      MIN. ANGLE= -0 DEG.     OFF AZIMUTH    0 DEG.
PWR=200.00KW          3 MC/S MAN. NOISE = -148 DBW        REQ.S/N=  6DB
                            OPERATING FREQUENCIES
```

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	13.0														
	1F	1E	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	16	3	14	13	13	13	15	17	17	-	-	-	-	-	ANGLE
	50	99	99	99	98	94	70	31	6	-	-	-	-	-	PROB.
	68	63	66	66	66	66	67	68	68	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	241	227	230	232	234	236	240	243	245	-	-	-	-	-	FS.LOSS
	4	30	14	12	10	8	6	4	2	-	-	-	-	-	P. LOSS
	27	1	16	18	21	23	26	28	30	-	-	-	-	-	S/N..DB
	99	20	95	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	15.8														
	1F	1E	1E	1E	1E	1E	1E	1F	1F	1F	-	-	-	-	MODE
	15	3	3	3	3	3	4	13	15	15	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	73	48	20	-	-	-	-	PROB.
	67	63	63	63	63	63	63	66	67	67	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	244	229	229	232	234	236	239	242	245	247	-	-	-	-	FS.LOSS
	8	70	60	48	40	20	16	12	8	6	-	-	-	-	P. LOSS
	24	-41	-29	-16	-6	10	16	20	24	26	-	-	-	-	S/N..DB
	99	0	0	0	5	80	98	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	16.4														
	1F	1E	1E	1E	1E	1E	1E	1E	1F	1F	-	-	-	-	MODE
	13	3	3	3	3	3	3	4	13	14	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	56	28	-	-	-	-	PROB.
	66	63	63	63	63	63	63	63	66	66	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	245	226	232	234	234	235	239	242	244	247	-	-	-	-	FS.LOSS
	14	130	86	74	64	54	26	20	14	12	-	-	-	-	P. LOSS
	19	-98	-57	-44	-32	-21	6	12	18	21	-	-	-	-	S/N..DB
	99	0	0	0	0	0	56	89	99	99	-	-	-	-	S/N..PROB.
														93	=T.REL.
8	17.6														
	1E	1E	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	MODE
	4	3	3	3	3	3	3	3	4	12	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	99	23	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	63	66	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	158	169	-	-	-	-	NOISE
	246	226	229	234	236	238	239	242	244	246	-	-	-	-	FS.LOSS
	16	164	126	88	76	66	48	24	20	16	-	-	-	-	P. LOSS
	17	-132	-95	-59	-46	-35	-16	8	13	17	-	-	-	-	S/N..DB
	98	0	0	0	0	0	0	69	91	98	-	-	-	-	S/N..PROB.
														98	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	17.8														
	1E	1E	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	MODE
	4	3	3	3	3	3	3	3	4	13	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	99	15	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	63	66	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	246	226	229	234	236	238	239	242	245	247	-	-	-	-	FS.LOSS
	16	170	130	88	76	64	50	24	18	16	-	-	-	-	P. LOSS
	17	-138	-99	-59	-46	-34	-17	8	14	18	-	-	-	-	S/N..DB
	98	0	0	0	0	0	0	69	94	99	-	-	-	-	S/N..PROB.
														98	=T.REL.
12	16.5														
	1E	1E	1E	1E	1E	1E	1E	1E	1E	1F	-	-	-	-	MODE
	4	3	3	3	3	3	3	3	4	14	-	-	-	-	ANGLE
	99	99	99	99	99	99	99	99	99	6	-	-	-	-	PROB.
	63	63	63	63	63	63	63	63	63	67	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	245	226	232	234	236	239	240	242	245	247	-	-	-	-	FS.LOSS
	14	144	90	78	66	54	26	20	16	12	-	-	-	-	P. LOSS
	18	-112	-61	-48	-35	-25	5	11	17	20	-	-	-	-	S/N..DB
	99	0	0	0	0	0	49	85	98	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	15.1														
	1F	2F	1E	1E	1E	1E	1E	1F	1F	1F	-	-	-	-	MODE
	14	30	3	3	3	3	3	13	15	15	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	69	31	5	-	-	-	-	PROB.
	67	74	63	63	63	63	63	66	67	67	-	-	-	-	DELAY
	167	156	158	159	160	161	163	165	168	169	-	-	-	-	NOISE
	244	229	232	232	234	235	239	242	245	247	-	-	-	-	FS.LOSS
	12	80	68	60	48	40	18	14	10	8	-	-	-	-	P. LOSS
	21	-52	-39	-27	-16	-8	11	17	22	24	-	-	-	-	S/N..DB
	99	0	0	0	0	4	84	99	99	99	-	-	-	-	S/N..PROB.
														96	=T.REL.
16	16.5														
	1F	2F	2F	1E	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	14	26	26	3	12	11	11	12	13	14	-	-	-	-	ANGLE
	50	99	99	99	99	99	97	86	59	24	-	-	-	-	PROB.
	67	71	71	63	66	65	65	66	66	67	-	-	-	-	DELAY
	168	153	154	155	157	158	161	165	166	169	-	-	-	-	NOISE
	245	227	229	232	234	236	239	242	244	247	-	-	-	-	FS.LOSS
	4	44	34	28	16	14	10	6	6	4	-	-	-	-	P. LOSS
	28	-16	-6	0	12	14	19	24	28	29	-	-	-	-	S/N..DB
	99	0	7	22	84	93	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	17.0														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	15	10	10	10	10	11	11	12	13	15	-	-	-	-	ANGLE
	50	99	99	99	99	99	93	89	66	31	-	-	-	-	PROB.
	67	65	65	65	65	65	65	66	66	67	-	-	-	-	DELAY
	169	151	153	155	157	159	163	166	168	169	-	-	-	-	NOISE
	246	227	230	232	234	236	239	242	244	247	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	2	2	-	-	-	-	P. LOSS
	32	15	18	20	22	24	28	30	31	31	-	-	-	-	S/N..DB
	99	96	99	99	99	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	15.5														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	16	11	11	11	11	12	12	14	16	16	-	-	-	-	ANGLE
	50	99	99	99	99	99	94	74	40	11	-	-	-	-	PROB.
	68	65	65	65	65	66	66	67	68	68	-	-	-	-	DELAY
	167	150	152	155	157	160	164	166	168	169	-	-	-	-	NOISE
	244	227	230	232	234	236	239	242	245	247	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	2	2	-	-	-	-	P. LOSS
	30	14	17	20	22	25	29	30	31	31	-	-	-	-	S/N..DB
	99	97	99	99	99	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	13.8														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	17	12	12	12	13	13	14	17	17	-	-	-	-	-	ANGLE
	50	99	99	99	99	97	81	45	11	-	-	-	-	-	PROB.
	68	66	66	66	66	66	67	68	68	-	-	-	-	-	DELAY
	166	150	153	156	158	161	164	166	168	-	-	-	-	-	NOISE
	242	227	230	232	234	236	240	243	245	-	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	2	-	-	-	-	-	P. LOSS
	30	14	18	22	24	26	29	30	31	-	-	-	-	-	S/N..DB
	99	96	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	12.3														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	17	12	13	13	13	14	16	17	-	-	-	-	-	-	ANGLE
	50	99	99	99	97	90	57	18	-	-	-	-	-	-	PROB.
	68	66	66	66	66	67	68	68	-	-	-	-	-	-	DELAY
	165	152	154	157	160	162	164	166	-	-	-	-	-	-	NOISE
	240	227	230	232	234	236	240	243	-	-	-	-	-	-	FS.LOSS
	2	10	6	6	4	4	2	2	-	-	-	-	-	-	P. LOSS
	30	17	19	23	26	27	29	30	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

35 JUN SSN= 100. 36.018

TO AZIMUTHS N.MILES

360.0 1800.9

SIGMA= 1000 SQ. METERS ANT= 25DB

OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.

PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	17.5														
	1F	3F	2F	2X	2E	2F	1F	1F	1F	1F	1F	-	-	-	MODE
	4	24	16	8	5	16	3	3	4	4	4	-	-	-	ANGLE
	50	99	99	99	99	89	98	91	71	42	9	-	-	-	PROB.
	117	128	121	116	114	121	116	116	116	117	117	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	256	239	241	243	245	247	249	252	254	256	259	-	-	-	FS.LOSS
	6	70	42	36	32	28	12	8	6	6	4	-	-	-	P. LOSS
	16	-53	-24	-18	-12	-8	8	12	14	16	17	-	-	-	S/N..DB
	95	0	0	0	1	3	67	85	90	95	97	-	-	-	S/N..PROB.
														88	=T.REL.
4	19.1														
	1F	2F	2E	2E	2E	2E	2E	2F	1F	1F	1F	1F	-	-	MODE
	4	4	4	4	4	4	5	18	3	3	4	4	-	-	ANGLE
	50	99	99	99	99	99	99	36	81	62	27	6	-	-	PROB.
	117	113	113	113	113	114	114	123	116	116	116	116	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	257	237	241	244	245	247	250	253	254	256	259	261	-	-	FS.LOSS
	10	158	100	86	56	48	38	30	14	12	8	6	-	-	P. LOSS
	11	-138	-83	-69	-36	-29	-18	-10	7	10	13	16	-	-	S/N..DB
	84	0	0	0	0	0	0	2	60	81	92	97	-	-	S/N..PROB.
														65	=T.REL.
6	19.4														
	1F	2F	2E	2E	2E	2E	2E	2E	2F	1F	1F	1F	-	-	MODE
	4	4	4	4	4	4	5	5	16	3	3	3	-	-	ANGLE
	50	99	99	99	99	99	99	99	9	65	31	7	-	-	PROB.
	116	113	113	113	113	113	114	114	121	116	116	116	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	258	237	239	244	246	248	250	253	255	256	259	261	-	-	FS.LOSS
	16	242	188	120	104	88	54	42	36	18	14	10	-	-	P. LOSS
	6	-222	-168	-102	-85	-71	-34	-22	-14	3	8	12	-	-	S/N..DB
	55	0	0	0	0	0	0	0	0	34	69	87	-	-	S/N..PROB.
														40	=T.REL.
8	20.0														
	1F	2E	2E	2E	2E	2E	2E	2E	2E	-	1F	1F	-	-	MODE
	2	4	4	4	4	[illegible]	4	5	5	-	2	2	-	-	ANGLE
	50	99	99	99	99	99	99	99	99	-	35	6	-	-	PROB.
	115	113	113	113	113	113	114	114	114	-	115	115	-	-	DELAY
	171	156	158	159	161	162	164	166	168	-	171	173	-	-	NOISE
	258	237	239	242	246	248	250	253	255	-	259	261	-	-	FS.LOSS
	18	298	230	184	122	106	64	50	42	-	16	14	-	-	P. LOSS
	5	-277	-210	-164	-102	-87	-42	-28	-19	-	6	11	-	-	S/N..DB
	43	0	0	0	0	0	0	0	0	-	55	83	-	-	S/N..PROB.
														22	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	19.7														
	1F	2E	2E	2E	2E	2E	2E	2E	2E	-	1F	-	-	-	MODE
	3	4	4	4	4	4	4	5	5	-	3	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	99	-	30	-	-	-	PROB.
	116	113	113	113	113	113	114	114	114	-	116	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	-	171	-	-	-	NOISE
	258	237	239	242	246	248	250	253	255	-	259	-	-	-	FS.LOSS
	20	306	238	190	122	106	64	50	42	-	18	-	-	-	P. LOSS
	2	-287	-218	-170	-104	-87	-44	-30	-21	-	5	-	-	-	S/N..DB
	29	0	0	0	0	0	0	0	0	-	48	-	-	-	S/N..PROB.
														15	=T.REL.
12	19.2														
	1F	2E	2E	2E	2E	2E	2E	2E	-	1F	1F	-	-	-	MODE
	3	4	4	4	4	4	4	5	-	4	3	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	-	66	21	-	-	-	PROB.
	116	113	113	113	113	113	114	114	-	117	116	-	-	-	DELAY
	170	156	158	159	161	162	164	166	-	169	171	-	-	-	NOISE
	257	237	239	244	246	248	250	253	-	256	259	-	-	-	FS.LOSS
	18	264	206	124	108	92	56	44	-	18	14	-	-	-	P. LOSS
	4	-246	-186	-107	-90	-75	-36	-24	-	2	7	-	-	-	S/N..DB
	40	0	0	0	0	0	0	0	-	28	62	-	-	-	S/N..PROB.
														30	=T.REL.
14	19.2														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	1F	-	-	-	MODE
	4	4	4	4	4	4	5	17	3	3	3	-	-	-	ANGLE
	50	99	99	99	99	99	99	30	87	66	21	-	-	-	PROB.
	117	113	113	113	113	114	114	123	116	116	116	-	-	-	DELAY
	170	156	158	159	160	161	163	165	168	169	171	-	-	-	NOISE
	257	237	242	244	246	247	250	253	254	256	259	-	-	-	FS.LOSS
	12	186	114	98	84	56	42	34	16	14	10	-	-	-	P. LOSS
	11	-167	-95	-79	-66	-36	-23	-14	5	8	12	-	-	-	S/N..DB
	84	0	0	0	0	0	0	0	45	69	88	-	-	-	S/N..PROB.
														57	=T.REL.
16	20.3														
	1F	3F	3F	2F	2F	2X	2F	1F	1F	1F	1F	1F	-	-	MODE
	4	23	22	15	14	8	14	2	2	2	3	3	-	-	ANGLE
	50	99	99	99	99	99	87	99	93	79	38	7	-	-	PROB.
	116	127	125	120	119	115	120	115	115	115	116	116	-	-	DELAY
	171	153	154	155	157	158	161	165	168	169	171	173	-	-	NOISE
	258	239	241	243	245	246	250	252	254	256	259	261	-	-	FS.LOSS
	6	88	74	46	40	36	28	12	10	8	6	4	-	-	P. LOSS
	14	-75	-63	-34	-27	-22	-13	5	10	12	14	16	-	-	S/N..DB
	93	0	0	0	0	0	0	44	78	89	94	97	-	-	S/N..PROB.
														84	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	21.1														
	1F	2F	2F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	MODE
	4	13	13	2	1	1	1	1	2	2	4	4	-	-	ANGLE
	50	99	99	99	99	99	99	99	96	85	51	13	-	-	PROB.
	116	119	118	115	115	115	115	115	115	115	116	116	-	-	DELAY
	171	151	153	155	157	159	163	166	168	169	171	173	-	-	NOISE
	259	238	240	242	244	246	249	252	254	256	259	261	-	-	FS.LOSS
	2	30	24	10	8	8	6	4	4	2	2	2	-	-	P. LOSS
	18	-18	-13	2	5	7	11	14	16	16	18	19	-	-	S/N..DB
	99	0	0	23	44	62	91	94	97	97	99	99	-	-	S/N..PROB.
														99	=T.REL.
20	20.0														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	MODE
	4	2	1	1	1	1	2	2	2	3	4	4	-	-	ANGLE
	50	99	99	99	99	99	99	98	91	75	36	7	-	-	PROB.
	117	115	115	115	115	115	115	115	115	116	117	117	-	-	DELAY
	171	150	152	155	157	160	164	166	168	169	171	173	-	-	NOISE
	258	237	240	242	244	246	249	252	254	256	259	261	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	2	2	-	-	P. LOSS
	20	-1	1	5	8	11	15	17	18	19	20	21	-	-	S/N..DB
	99	7	17	43	75	91	95	98	98	99	99	99	-	-	S/N..PROB.
														99	=T.REL.
22	17.9														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	5	2	2	2	2	2	2	3	3	5	5	-	-	-	ANGLE
	50	99	99	99	99	99	99	93	76	47	9	-	-	-	PROB.
	117	115	115	115	115	115	115	116	116	117	117	-	-	-	DELAY
	169	150	153	156	158	161	164	166	168	169	171	-	-	-	NOISE
	256	237	240	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	2	-	-	-	P. LOSS
	19	-1	3	7	9	12	15	17	19	19	20	-	-	-	S/N..DB
	99	10	27	60	84	96	96	98	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
24	16.3														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	5	4	3	2	2	2	3	3	4	5	-	-	-	-	ANGLE
	50	99	99	99	99	99	96	83	55	24	-	-	-	-	PROB.
	117	116	116	115	115	115	116	116	117	117	-	-	-	-	DELAY
	168	152	154	157	160	162	164	166	168	169	-	-	-	-	NOISE
	255	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	-	-	-	-	P. LOSS
	18	0	4	8	11	14	15	17	19	19	-	-	-	-	S/N..DB
	99	14	40	70	88	94	96	98	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

27 MAR SSN= 10. 36.005
TO AZIMUTHS N.MILES
359.9 499.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	5.1														
	1F	1F	-	-	-	-	-	-	-	-	-	-	-	-	MODE
	32	32	-	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	12	-	-	-	-	-	-	-	-	-	-	-	-	PROB.
	38	38	-	-	-	-	-	-	-	-	-	-	-	-	DELAY
	154	156	-	-	-	-	-	-	-	-	-	-	-	-	NOISE
	215	218	-	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	4	-	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	35	-	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	-	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
4	7.7														
	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	MODE
	26	23	24	27	27	-	-	-	-	-	-	-	-	-	ANGLE
	50	93	73	39	12	-	-	-	-	-	-	-	-	-	PROB.
	36	35	35	36	36	-	-	-	-	-	-	-	-	-	DELAY
	159	156	158	159	161	-	-	-	-	-	-	-	-	-	NOISE
	221	216	219	222	224	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	10	8	6	4	-	-	-	-	-	-	-	-	-	P. LOSS
	35	30	33	35	37	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	9.7														
	1F	1E	1E	1E	1F	1F	1F	-	-	-	-	-	-	-	MODE
	24	12	13	14	23	25	25	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	69	42	5	-	-	-	-	-	-	-	PROB.
	35	32	32	33	35	36	35	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	225	215	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	12	44	22	18	14	10	8	-	-	-	-	-	-	-	P. LOSS
	30	-1	19	24	28	31	34	-	-	-	-	-	-	-	S/N..DB
	99	16	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	10.0														
	1F	1E	1E	1E	1E	1F	1F	-	-	-	-	-	-	-	MODE
	24	12	12	13	14	24	25	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	50	5	-	-	-	-	-	-	-	PROB.
	35	32	32	32	33	35	35	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	225	215	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	16	64	30	26	20	16	12	-	-	-	-	-	-	-	P. LOSS
	26	-20	11	16	22	26	31	-	-	-	-	-	-	-	S/N..DB
	99	0	83	98	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	10.4														
	1F	1E	1E	1E	1E	1F	1F	-	-	-	-	-	-	-	MODE
	25	12	12	13	14	24	26	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	59	11	-	-	-	-	-	-	-	PROB.
	35	32	32	32	32	35	36	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	226	215	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	16	66	30	26	22	18	12	-	-	-	-	-	-	-	P. LOSS
	27	-23	11	15	21	25	31	-	-	-	-	-	-	-	S/N..DB
	99	0	83	96	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	10.2														
	1F	1E	1E	1E	1F	1F	1F	-	-	-	-	-	-	-	MODE
	24	12	12	13	22	24	25	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	77	55	8	-	-	-	-	-	-	-	PROB.
	35	32	32	32	35	35	35	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	226	215	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	12	52	26	20	16	14	10	-	-	-	-	-	-	-	P. LOSS
	29	-9	16	20	25	29	33	-	-	-	-	-	-	-	S/N..DB
	99	2	97	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	10.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	24	21	20	21	21	23	25	-	-	-	-	-	-	-	ANGLE
	50	99	98	91	77	54	7	-	-	-	-	-	-	-	PROB.
	35	34	34	34	34	35	35	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	225	216	218	221	223	225	228	-	-	-	-	-	-	-	FS.LOSS
	6	18	14	12	8	6	4	-	-	-	-	-	-	-	P. LOSS
	35	23	28	30	34	35	38	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	8.8														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	26	21	22	23	27	27	-	-	-	-	-	-	-	-	ANGLE
	50	97	89	71	46	25	-	-	-	-	-	-	-	-	PROB.
	36	34	34	35	36	36	-	-	-	-	-	-	-	-	DELAY
	159	156	158	159	159	161	-	-	-	-	-	-	-	-	NOISE
	223	216	219	221	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	-	-	-	-	-	-	-	-	P. LOSS
	37	35	37	38	37	38	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	6.7														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	30	27	30	30	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	73	41	16	-	-	-	-	-	-	-	-	-	-	PROB.
	37	36	37	37	-	-	-	-	-	-	-	-	-	-	DELAY
	155	154	155	157	-	-	-	-	-	-	-	-	-	-	NOISE
	219	217	220	222	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	6	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	33	34	35	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-		-	-	-	-	-	-	S/N..PROB.
														85	=T.REL.
20	5.9														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	32	32	32	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	46	14	-	-	-	-	-	-	-	-	-	-	-	PROB.
	38	38	38	-	-	-	-	-	-	-	-	-	-	-	DELAY
	152	152	154	-	-	-	-	-	-	-	-	-	-	-	NOISE
	218	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	31	31	32	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														55	=T.REL.
22	5.6														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	34	34	34	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	32	7	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	39	-	-	-	-	-	-	-	-	-	-	-	DELAY
	152	153	155	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	30	31	33	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
24	5.6														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	33	33	33	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	32	5	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	39	-	-	-	-	-	-	-	-	-	-	-	DELAY
	154	155	157	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	33	35	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														5[illegible]	=T.REL.

31 MAR SSN= 1C. 36.010
TO AZIMUTHS N.MILES
359.9 1000.3
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	7.6														
	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	MODE
	15	12	13	15	15	-	-	-	-	-	-	-	-	-	ANGLE
	50	91	69	36	11	-	-	-	-	-	-	-	-	-	PROB.
	[illegible]	66	66	67	67	-	-	-	-	-	-	-	-	-	DELAY
	159	156	158	159	161	-	-	-	-	-	-	-	-	-	NOISE
	232	227	230	233	235	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	10	6	4	4	-	-	-	-	-	-	-	-	-	P. LOSS
	25	21	23	25	27	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														98	=T.REL.
4	11.7														
	1F	1E	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	12	3	11	10	10	10	12	12	-	-	-	-	-	-	ANGLE
	50	99	99	98	94	84	44	11	-	-	-	-	-	-	PROB.
	66	63	65	65	65	65	66	66	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	239	227	230	232	234	236	239	242	-	-	-	-	-	-	FS.LOSS
	6	24	14	10	8	8	4	4	-	-	-	-	-	-	P. LOSS
	27	7	17	19	22	24	27	29	-	-	-	-	-	-	S/N..DB
	99	60	98	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	15.2														
	1F	2F	1E	1E	1E	1E	1F	1F	1F	1F	-	-	-	-	MODE
	11	25	3	3	3	3	9	10	11	11	-	-	-	-	ANGLE
	50	99	99	99	99	99	92	70	36	11	-	-	-	-	PROB.
	65	71	63	63	63	63	65	65	65	65	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	243	227	229	232	234	236	239	242	244	246	-	-	-	-	FS.LOSS
	8	60	46	38	30	18	14	10	8	6	-	-	-	-	P. LOSS
	24	-29	-15	-5	2	13	18	22	25	27	-	-	-	-	S/N..DB
	99	0	0	7	25	92	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	15.5														
	1F	1E	1E	1E	1E	1E	1E	1F	1F	1F	-	-	-	-	MODE
	11	3	3	3	3	3	4	10	11	11	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	70	42	13	-	-	-	-	PROB.
	65	63	63	63	63	63	63	65	65	65	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	244	226	229	232	234	235	239	242	244	246	-	-	-	-	FS.LOSS
	12	86	66	54	44	36	20	14	12	10	-	-	-	-	P. LOSS
	[illegible]	-55	-35	-21	-10	-3	13	18	22	24	-	-	-	-	S/N..DB
	99	0	0	0	1	11	92	99	99	99	-	-	-	-	S/N..PROB.
														98	=T.REL.

		OPERATING FREQUENCIES													
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	15.7														
	1F	1E	1E	1E	1E	1E	1E	1F	1F	1F	-	-	-	-	MODE
	11	3	3	3	3	3	3	10	11	11	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	72	45	15	-	-	-	-	PROB.
	65	63	63	63	63	63	63	65	65	65	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	244	226	229	232	234	235	239	242	244	246	-	-	-	-	FS.LOSS
	12	90	70	56	46	38	20	16	12	10	-	-	-	-	P. LOSS
	21	-59	-38	-24	-12	-5	12	17	22	24	-	-	-	-	S/N..DB
	99	0	0	0	1	7	89	98	99	99	-	-	-	-	S/N..PROB.
														98	=T.REL.
12	15.5														
	1F	1E	1E	1E	1E	1E	1E	1F	1F	1F	-	-	-	-	MODE
	11	3	3	3	3	3	4	9	10	10	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	74	39	9	-	-	-	-	PROB.
	65	63	63	63	63	63	63	65	65	65	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	244	226	229	232	234	235	239	242	244	246	-	-	-	-	FS.LOSS
	10	70	54	44	36	30	16	12	10	8	-	-	-	-	P. LOSS
	23	-39	-27	-12	-3	3	16	20	24	26	-	-	-	-	S/N..DB
	99	0	0	1	10	33	98	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	15.7														
	1F	2F	1E	1E	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	11	22	3	3	9	8	8	9	11	11	-	-	-	-	ANGLE
	50	99	99	99	99	99	94	76	43	12	-	-	-	-	PROB.
	65	69	63	63	65	64	64	65	65	65	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	244	227	229	232	234	236	239	242	244	246	-	-	-	-	FS.LOSS
	4	36	28	22	14	12	8	6	4	4	-	-	-	-	P. LOSS
	28	-4	3	9	17	19	23	26	28	29	-	-	-	-	S/N..DB
	99	8	31	76	98	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	13.9														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	12	8	8	8	8	8	9	12	12	12	-	-	-	-	ANGLE
	50	99	99	99	97	93	77	49	23	7	-	-	-	-	PROB.
	66	64	64	64	64	64	65	66	66	66	-	-	-	-	DELAY
	166	156	158	159	159	161	163	166	168	169	-	-	-	-	NOISE
	242	227	230	232	234	236	239	242	244	246	-	-	-	-	FS.LOSS
	2	12	8	6	6	4	4	2	2	2	-	-	-	-	P. LOSS
	30	19	22	24	24	26	28	30	31	32	-	-	-	-	S/N..DB
	99	99	98	99	99	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
						OPERATING FREQUENCIES									
18	10.7														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	14	10	10	10	11	12	14	14	-	-	-	-	-	-	ANGLE
	50	99	97	91	80	64	28	7	-	-	-	-	-	-	PROB.
	66	65	65	65	65	66	66	66	-	-	-	-	-	-	DELAY
	162	154	155	157	159	161	164	166	-	-	-	-	-	-	NOISE
	238	227	230	232	234	236	240	242	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	2	2	-	-	-	-	-	-	P. LOSS
	27	18	21	22	24	26	29	30	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	9.1														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	15	11	12	13	15	15	15	-	-	-	-	-	-	-	ANGLE
	50	96	88	73	51	30	5	-	-	-	-	-	-	-	PROB.
	67	65	66	66	67	67	67	-	-	-	-	-	-	-	DELAY
	159	152	154	157	159	162	164	-	-	-	-	-	-	-	NOISE
	235	227	230	232	235	237	240	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	2	-	-	-	-	-	-	-	P. LOSS
	25	16	19	23	25	27	29	-	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	8.3														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	16	13	13	15	16	16	-	-	-	-	-	-	-	-	ANGLE
	50	92	79	58	35	16	-	-	-	-	-	-	-	-	PROB.
	68	66	66	67	68	68	-	-	-	-	-	-	-	-	DELAY
	159	153	155	158	161	162	-	-	-	-	-	-	-	-	NOISE
	233	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	25	18	20	24	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	8.3														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	16	12	13	14	16	16	-	-	-	-	-	-	-	-	ANGLE
	50	96	84	60	29	9	-	-	-	-	-	-	-	-	PROB.
	67	66	66	67	68	68	-	-	-	-	-	-	-	-	DELAY
	160	155	157	159	161	162	-	-	-	-	-	-	-	-	NOISE
	233	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	6	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	20	22	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

35 MAR SSN= 1C. 36.018
TO AZIMUTHS N.MILES
36C.0 1800.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	8.5														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	4	2	2	3	4	4	-	-	-	-	-	-	-	-	ANGLE
	50	97	88	66	36	12	-	-	-	-	-	-	-	-	PROB.
	116	115	115	116	116	116	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	243	237	240	242	244	246	-	-	-	-	-	-	-	-	FS.LOSS
	8	14	10	8	6	6	-	-	-	-	-	-	-	-	P. LOSS
	13	5	9	11	14	15	-	-	-	-	-	-	-	-	S/N..DB
	90	46	71	84	92	94	-	-	-	-	-	-	-	-	S/N..PROB.
														75	=T.REL.
4	13.0														
	1F	2F	2E	2F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	2	13	5	13	2	1	2	2	2	-	-	-	-	-	ANGLE
	50	99	99	84	98	94	70	31	7	-	-	-	-	-	PROB.
	115	119	114	118	115	115	115	115	115	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	251	238	240	242	244	246	249	252	254	-	-	-	-	-	FS.LOSS
	6	36	30	26	12	10	6	6	4	-	-	-	-	-	P. LOSS
	15	-17	-11	-7	8	10	13	16	18	-	-	-	-	-	S/N..DB
	96	0	1	5	66	80	92	97	99	-	-	-	-	-	S/N..PROB.
														92	=T.REL.
6	17.3														
	1F	2E	2E	2E	2E	2E	2F	1F	1F	1F	1F	-	-	-	MODE
	2	4	4	4	5	5	13	1	1	1	1	-	-	-	ANGLE
	50	99	99	99	99	99	59	90	69	39	8	-	-	-	PROB.
	115	113	113	114	114	114	118	115	115	115	115	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	255	237	239	242	245	246	250	252	254	256	259	-	-	-	FS.LOSS
	8	104	80	64	42	38	30	12	10	8	6	-	-	-	P. LOSS
	13	-84	-61	-45	-23	-18	-9	8	12	14	16	-	-	-	S/N..DB
	90	0	0	0	0	0	3	69	87	94	97	-	-	-	S/N..PROB.
														77	=T.REL.
8	18.6														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	1F	-	-	-	MODE
	1	4	4	4	4	5	5	13	1	1	1	-	-	-	ANGLE
	50	99	99	99	99	99	99	34	77	57	18	-	-	-	PROB.
	115	113	113	113	114	114	114	119	115	115	115	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	257	237	241	243	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	10	146	100	88	74	48	38	30	14	12	8	-	-	-	P. LOSS
	12	-127	-83	-70	-54	-29	-18	-10	8	10	14	-	-	-	S/N..DB
	85	0	0	0	0	0	0	2	65	79	93	-	-	-	S/N..PROB.
														60	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	19.5														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	1F	-	-	-	MODE
	2	4	4	4	4	4	5	13	1	1	1	-	-	-	ANGLE
	50	99	99	99	99	99	99	50	83	66	29	-	-	-	PROB.
	115	113	113	113	114	114	114	119	115	115	115	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	257	237	239	243	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	10	152	118	92	78	50	40	32	14	12	8	-	-	-	P. LOSS
	12	-132	-98	-72	-57	-30	-19	-10	8	10	14	-	-	-	S/N..DB
	81	0	0	0	0	0	0	2	62	73	86	-	-	-	S/N..PROB.
														65	=T.REL.
12	19.3														
	1F	2E	2E	2E	2E	2E	2F	1F	1F	1F	1F	-	-	-	MODE
	2	4	4	4	4	5	12	1	1	1	1	-	-	-	ANGLE
	50	99	99	99	99	99	83	97	87	67	24	-	-	-	PROB.
	115	113	113	113	114	114	118	115	114	115	115	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	257	237	241	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	8	120	90	76	62	42	34	14	12	10	6	-	-	-	P. LOSS
	14	-101	-70	-55	-41	-22	-12	7	11	13	16	-	-	-	S/N..DB
	86	0	0	0	0	0	1	59	75	84	91	-	-	-	S/N..PROB.
														75	=T.REL.
14	18.9														
	1F	3F	2E	2F	2F	2F	1F	1F	1F	1F	1F	-	-	-	MODE
	1	19	4	11	11	11	0	0	0	1	1	-	-	-	ANGLE
	50	99	99	99	99	97	99	96	85	63	19	-	-	-	PROB.
	115	122	114	117	117	117	114	114	114	115	115	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	257	237	239	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	4	64	50	36	30	26	10	8	6	4	4	-	-	-	P. LOSS
	16	-46	-32	-17	-12	-8	9	12	14	15	17	-	-	-	S/N..DB
	96	0	0	0	1	4	74	87	92	95	97	-	-	-	S/N..PROB.
														94	=T.REL.
16	16.5														
	1F	2F	2F	2F	2F	2F	1F	1F	1F	1F	1F	-	-	-	MODE
	2	10	10	11	11	12	0	1	2	2	2	-	-	-	ANGLE
	50	99	99	97	92	83	93	79	56	33	9	-	-	-	PROB.
	115	117	117	117	117	118	114	114	115	115	115	-	-	-	DELAY
	168	156	158	159	159	161	163	166	168	169	171	-	-	-	NOISE
	255	237	240	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	2	26	22	20	18	16	4	4	2	2	2	-	-	-	P. LOSS
	18	-8	-3	-1	-0	2	14	17	18	19	20	-	-	-	S/N..DB
	98	4	15	19	24	28	92	97	98	99	99	-	-	-	S/N..PROB.
														98	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	12.5														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	3	0	1	1	1	1	2	3	3	-	-	-	-	-	ANGLE
	50	99	99	97	93	85	58	27	8	-	-	-	-	-	PROB.
	116	114	114	114	115	115	115	116	116	-	-	-	-	-	DELAY
	165	154	155	157	159	161	164	166	168	-	-	-	-	-	NOISE
	250	237	240	242	244	246	249	252	254	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	4	2	-	-	-	-	-	P. LOSS
	16	2	5	7	10	12	15	17	18	-	-	-	-	-	S/N..DB
	96	29	44	62	79	88	95	97	98	-	-	-	-	-	S/N..PROB.
														96	=T.REL.
20	10.3														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	1	1	2	2	3	3	-	-	-	-	-	-	-	ANGLE
	50	98	95	88	74	56	21	-	-	-	-	-	-	-	PROB.
	116	115	115	115	115	116	116	-	-	-	-	-	-	-	DELAY
	163	152	154	157	159	162	164	-	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	15	0	4	8	11	14	16	-	-	-	-	-	-	-	S/N..DB
	88	22	44	63	80	89	92	-	-	-	-	-	-	-	S/N..PROB.
														82	=T.REL.
22	9.6														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	3	3	4	4	-	-	-	-	-	-	-	ANGLE
	50	97	92	81	63	42	11	-	-	-	-	-	-	-	PROB.
	117	115	115	116	116	117	117	-	-	-	-	-	-	-	DELAY
	162	153	155	158	161	162	164	-	-	-	-	-	-	-	NOISE
	245	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	15	2	6	10	14	15	17	-	-	-	-	-	-	-	S/N..DB
	91	29	55	76	88	92	96	-	-	-	-	-	-	-	S/N..PROB.
														84	=T.REL.
24	9.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	4	2	2	3	3	4	-	-	-	-	-	-	-	-	ANGLE
	50	99	95	83	60	33	-	-	-	-	-	-	-	-	PROB.
	116	115	115	116	116	116	-	-	-	-	-	-	-	-	DELAY
	161	155	157	159	161	162	-	-	-	-	-	-	-	-	NOISE
	245	237	240	242	244	246	-	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	-	-	-	-	-	-	-	-	P. LOSS
	14	4	8	11	14	15	-	-	-	-	-	-	-	-	S/N..DB
	90	40	64	80	88	92	-	-	-	-	-	-	-	-	S/N..PROB.
														87	=T.REL.

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27            MAR                  SSN=  50.               36.005
              TO                              AZIMUTHS         N.MILES
                                                  359.9          499.9
SIGMA= 1000 SQ. METERS                                         ANT= 25DB
OFF AZIMUTH    0 DEG.      MIN. ANGLE= -0 DEG.     OFF AZIMUTH   0 DEG.
PWR=200.00KW         3 MC/S MAN. NOISE = -148 DBW        REQ.S/N=  6DB
                       OPERATING FREQUENCIES
```

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	5.9														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	34	34	34	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	44	11	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	39	-	-	-	-	-	-	-	-	-	-	-	DELAY
	156	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	218	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														52	=T.REL.
4	8.8														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	28	24	24	25	29	29	-	-	-	-	-	-	-	-	ANGLE
	50	98	92	74	45	19	-	-	-	-	-	-	-	-	PROB.
	37	35	35	36	37	37	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	224	216	219	222	224	226	-	-	-	-	-	-	-	-	FS.LOSS
	6	12	10	8	6	4	-	-	-	-	-	-	-	-	P. LOSS
	36	29	32	34	36	37	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	12.0														
	1F	1E	1F	1E	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	26	12	23	13	22	23	26	27	-	-	-	-	-	-	ANGLE
	50	99	99	99	95	87	50	13	-	-	-	-	-	-	PROB.
	36	32	35	32	34	35	36	36	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	229	215	219	221	223	225	229	232	-	-	-	-	-	-	FS.LOSS
	8	50	24	20	16	14	8	6	-	-	-	-	-	-	P. LOSS
	33	-7	17	21	26	29	33	36	-	-	-	-	-	-	S/N..DB
	99	4	98	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	12.7														
	1F	1E	1E	1E	1E	1F	1F	1F	-	-	-	-	-	-	MODE
	26	12	12	13	13	22	24	27	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	88	62	21	-	-	-	-	-	-	PROB.
	36	32	32	32	32	34	35	36	-	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	230	215	218	221	223	225	228	232	-	-	-	-	-	-	FS.LOSS
	12	72	56	28	24	20	14	10	-	-	-	-	-	-	P. LOSS
	31	-30	-12	13	18	23	29	33	-	-	-	-	-	-	S/N..DB
	99	0	1	93	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
						OPERATING FREQUENCIES									
10	12.9														
	1F	1E	1E	1E	1E	1F	1F	1F	-	-	-	-	-	-	MODE
	27	12	12	12	13	23	25	28	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	89	65	25	-	-	-	-	-	-	PROB.
	36	32	32	32	32	35	35	36	-	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	230	215	218	221	223	225	229	232	-	-	-	-	-	-	FS.LOSS
	12	76	58	28	24	20	14	10	-	-	-	-	-	-	P. LOSS
	31	-33	-15	12	18	22	29	33	-	-	-	-	-	-	S/N..DB
	99	0	0	90	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	12.5														
	1F	1E	1F	1E	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	26	12	24	13	23	23	25	27	-	-	-	-	-	-	ANGLE
	50	99	99	99	96	90	60	17	-	-	-	-	-	-	PROB.
	36	32	35	32	35	35	35	36	-	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	230	215	219	221	223	225	229	232	-	-	-	-	-	-	FS.LOSS
	10	60	28	24	20	16	10	8	-	-	-	-	-	-	P. LOSS
	33	-16	13	18	23	26	32	35	-	-	-	-	-	-	S/N..DB
	99	0	91	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	12.3														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	26	22	21	21	21	22	25	27	-	-	-	-	-	-	ANGLE
	50	99	99	99	96	88	56	13	-	-	-	-	-	-	PROB.
	36	35	34	34	34	34	35	36	-	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	229	216	219	221	223	225	229	232	-	-	-	-	-	-	FS.LOSS
	4	20	16	12	10	8	6	4	-	-	-	-	-	-	P. LOSS
	38	21	26	29	32	34	37	39	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	10.5														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	28	21	22	23	24	26	28	-	-	-	-	-	-	-	ANGLE
	50	99	97	92	80	62	24	-	-	-	-	-	-	-	PROB.
	36	34	34	35	35	36	37	-	-	-	-	-	-	-	DELAY
	161	156	158	159	159	161	163	-	-	-	-	-	-	-	NOISE
	227	216	219	221	223	226	229	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	2	-	-	-	-	-	-	-	P. LOSS
	38	35	37	38	37	39	39	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
						OPERATING FREQUENCIES									
18	7.9														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	31	26	28	31	31	31	-	-	-	-	-	-	-	-	ANGLE
	50	92	75	48	24	9	-	-	-	-	-	-	-	-	PROB.
	38	36	36	38	38	38	-	-	-	-	-	-	-	-	DELAY
	157	154	155	157	159	161	-	-	-	-	-	-	-	-	NOISE
	223	217	220	223	225	227	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	2	2	2	-	-	-	-	-	-	-	-	P. LOSS
	35	33	35	35	36	38	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														98	=T.REL.
20	6.9														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	34	30	34	34	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	77	47	18	-	-	-	-	-	-	-	-	-	-	PROB.
	39	37	39	39	-	-	-	-	-	-	-	-	-	-	DELAY
	154	152	154	157	-	-	-	-	-	-	-	-	-	-	NOISE
	221	217	221	223	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	32	31	32	34	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														88	=T.REL.
22	6.6														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	35	32	35	35	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	68	35	10	-	-	-	-	-	-	-	-	-	-	PROB.
	40	38	40	40	-	-	-	-	-	-	-	-	-	-	DELAY
	154	153	155	158	-	-	-	-	-	-	-	-	-	-	NOISE
	220	218	221	224	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	32	31	33	35	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														80	=T.REL.
24	6.5														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	35	32	35	35	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	68	29	6	-	-	-	-	-	-	-	-	-	-	PROB.
	40	38	40	40	-	-	-	-	-	-	-	-	-	-	DELAY
	156	155	157	159	-	-	-	-	-	-	-	-	-	-	NOISE
	220	218	221	224	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	34	35	36	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														78	=T.REL.

31 MAR SSN= 50. 36.010
TO AZIMUTHS N.MILES
359.9 1000.3
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	8.5														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	16	12	13	15	16	16	-	-	-	-	-	-	-	-	ANGLE
	50	97	87	65	35	12	-	-	-	-	-	-	-	-	PROB.
	68	66	66	67	68	68	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	21	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	13.2														
	1F	1E	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	13	3	12	10	10	10	11	13	13	-	-	-	-	-	ANGLE
	50	99	99	99	98	95	73	35	9	-	-	-	-	-	PROB.
	66	63	66	65	65	65	65	66	66	-	-	-	-	-	DELAY
	166	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	241	227	230	232	234	236	239	242	244	-	-	-	-	-	FS.LOSS
	4	26	14	12	10	8	6	4	4	-	-	-	-	-	P. LOSS
	28	4	16	18	21	23	26	28	30	-	-	-	-	-	S/N..DB
	99	39	97	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	18.3														
	1F	1E	2F	1E	1E	1E	1E	1F	1F	1F	1F	-	-	-	MODE
	12	3	24	3	3	3	4	9	10	11	12	-	-	-	ANGLE
	50	99	99	99	99	99	99	94	80	54	17	-	-	-	PROB.
	66	63	70	63	63	63	63	65	65	65	66	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	247	226	229	232	234	235	239	242	244	246	249	-	-	-	FS.LOSS
	6	70	54	42	34	28	16	12	10	6	6	-	-	-	P. LOSS
	26	-38	-21	-11	-2	3	16	20	24	26	29	-	-	-	S/N..DB
	99	0	0	1	13	33	98	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
8	19.5														
	1F	1E	1E	1E	1E	1E	1E	1E	1F	1F	1F	1F	-	-	MODE
	11	3	3	3	3	3	3	4	9	10	12	12	-	-	ANGLE
	50	99	99	99	99	99	99	99	83	66	29	5	-	-	PROB.
	66	63	63	63	63	63	63	63	65	65	66	66	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	248	226	231	232	234	235	239	242	244	246	249	251	-	-	FS.LOSS
	8	98	74	60	50	42	22	18	14	10	8	6	-	-	P. LOSS
	25	-68	-44	-29	-17	-8	10	15	20	23	26	29	-	-	S/N..DB
	99	0	0	0	0	3	81	96	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.

SECRET

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	19.6														
	1F	1E	1E	1E	1E	1E	1E	1E	1F	1F	1F	1F	-	-	MODE
	12	3	3	3	3	3	3	4	10	11	12	12	-	-	ANGLE
	50	99	99	99	99	99	99	99	83	67	30	5	-	-	PROB.
	66	63	63	63	63	63	63	63	65	65	66	66	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	248	226	231	232	234	235	239	242	244	246	249	251	-	-	FS.LOSS
	8	104	76	64	52	44	22	18	14	10	8	6	-	-	P. LOSS
	25	-72	-46	-32	-19	-10	10	15	19	22	26	29	-	-	S/N..DB
	99	0	0	0	0	2	81	96	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.
12	19.0														
	1F	3F	2F	1E	1E	1E	1F	1F	1F	1F	1F	-	-	-	MODE
	12	34	24	3	3	3	10	9	10	11	12	-	-	-	ANGLE
	50	99	99	99	99	99	99	96	86	64	21	-	-	-	PROB.
	66	77	70	63	63	63	65	65	65	65	66	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	247	226	229	232	234	235	239	242	244	246	249	-	-	-	FS.LOSS
	8	82	62	50	40	34	18	14	10	8	6	-	-	-	P. LOSS
	26	-50	-31	-18	-8	-1	14	18	22	25	28	-	-	-	S/N..DB
	99	0	0	0	3	17	95	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
14	19.0														
	1F	2F	2F	1E	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	12	23	22	3	10	9	9	9	9	10	12	-	-	-	ANGLE
	50	99	99	99	99	99	99	96	85	64	20	-	-	-	PROB.
	66	69	69	63	65	65	64	65	65	65	66	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	247	227	229	232	234	236	239	242	244	246	249	-	-	-	FS.LOSS
	4	42	32	26	16	14	10	8	6	4	4	-	-	-	P. LOSS
	30	-10	-0	6	16	18	22	25	28	29	31	-	-	-	S/N..DB
	99	2	19	57	97	99	99	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
16	16.6														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	13	8	8	8	8	9	9	10	12	13	13	-	-	-	ANGLE
	50	99	99	99	99	98	93	79	57	33	9	-	-	-	PROB.
	66	64	64	64	64	64	65	65	66	66	66	-	-	-	DELAY
	168	156	158	159	159	161	163	166	168	169	171	-	-	-	NOISE
	245	227	230	232	234	236	239	242	244	246	249	-	-	-	FS.LOSS
	2	10	8	6	6	4	4	2	2	2	0	-	-	-	P. LOSS
	31	19	22	24	24	26	28	30	31	32	33	-	-	-	S/N..DB
	99	99	98	99	99	99	99	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	12.3														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	14	10	10	11	11	11	13	14	14	-	-	-	-	-	ANGLE
	50	99	99	97	93	84	56	25	7	-	-	-	-	-	PROB.
	67	65	65	65	65	66	66	67	67	-	-	-	-	-	DELAY
	165	154	155	157	159	161	164	166	168	-	-	-	-	-	NOISE
	240	227	230	232	234	236	240	242	245	-	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	2	-	-	-	-	-	P. LOSS
	30	18	21	22	24	26	29	30	31	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	10.3														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	16	12	12	13	13	15	16	-	-	-	-	-	-	-	ANGLE
	50	98	95	88	75	57	21	-	-	-	-	-	-	-	PROB.
	68	66	66	66	66	67	68	-	-	-	-	-	-	-	DELAY
	163	152	154	157	159	162	164	-	-	-	-	-	-	-	NOISE
	237	227	230	232	234	237	240	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	2	-	-	-	-	-	-	-	P. LOSS
	28	16	19	23	25	27	29	-	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	9.6														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	17	13	13	14	16	17	17	-	-	-	-	-	-	-	ANGLE
	50	97	92	80	62	42	11	-	-	-	-	-	-	-	PROB.
	68	66	66	67	67	68	68	-	-	-	-	-	-	-	DELAY
	162	153	155	158	161	162	164	-	-	-	-	-	-	-	NOISE
	236	227	230	233	235	237	240	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	6	4	4	2	-	-	-	-	-	-	-	P. LOSS
	28	18	21	24	27	27	29	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	9.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	17	13	13	14	16	17	-	-	-	-	-	-	-	-	ANGLE
	50	99	95	82	60	32	-	-	-	-	-	-	-	-	PROB.
	68	66	66	67	68	68	-	-	-	-	-	-	-	-	DELAY
	161	155	157	159	161	162	-	-	-	-	-	-	-	-	NOISE
	236	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	20	22	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

35 MAR SSN= 50. 36.018
TO AZIMUTHS N.MILES
360.0 1800.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148, DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	9.8														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	3	3	4	4	-	-	-	-	-	-	-	ANGLE
	50	99	97	89	71	46	7	-	-	-	-	-	-	-	PROB.
	117	115	115	116	116	117	117	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	246	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	15	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	94	46	71	84	92	94	98	-	-	-	-	-	-	-	S/N..PROB.
														93	=T.REL.
4	14.8														
	1F	2F	2X	2F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	3	14	9	13	2	2	1	2	2	2	-	-	-	-	ANGLE
	50	99	99	95	99	99	90	64	30	8	-	-	-	-	PROB.
	116	120	116	118	115	115	115	115	115	115	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	253	238	240	243	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	6	38	32	28	12	10	8	6	4	4	-	-	-	-	P. LOSS
	16	-20	-14	-9	7	9	12	15	17	18	-	-	-	-	S/N..DB
	97	0	0	3	60	74	89	96	98	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	20.4														
	1F	2E	3F	2E	2F	2X	2F	1F	1F	1F	1F	1F	-	-	MODE
	2	4	21	4	13	7	12	1	1	1	2	2	-	-	ANGLE
	50	99	99	99	99	99	89	98	93	79	43	13	-	-	PROB.
	115	113	124	113	119	115	118	115	115	115	115	115	-	-	DELAY
	171	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	258	237	241	242	245	246	249	252	254	256	259	261	-	-	FS.LOSS
	6	118	88	74	46	42	32	14	12	8	6	6	-	-	P. LOSS
	15	-99	-69	-54	-27	-21	-12	7	10	13	15	18	-	-	S/N..DB
	95	0	0	0	0	0	1	62	78	92	96	99	-	-	S/N..PROB.
														85	=T.REL.
8	22.8														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	1F	1F	1F	-	MODE
	2	4	4	4	4	4	5	12	1	1	1	2	2	-	ANGLE
	50	99	99	99	99	99	99	78	94	87	66	35	9	-	PROB.
	115	113	113	113	113	114	114	118	115	115	115	115	115	-	DELAY
	172	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	260	237	239	243	244	246	249	252	254	256	259	261	263	-	FS.LOSS
	8	166	130	96	86	54	44	34	16	12	10	8	6	-	P. LOSS
	14	-148	-110	-79	-65	-34	-23	-13	6	9	12	15	17	-	S/N..DB
	93	0	0	0	0	0	0	1	52	74	87	94	98	-	S/N..PROB.
														85	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	23.9														
	1F	2E	2E	2E	2E	2E	2E	2F	1F	1F	1F	1F	1F	-	MODE
	2	4	4	4	4	4	5	12	1	1	1	2	2	-	ANGLE
	50	99	99	99	99	99	99	84	96	91	74	49	18	-	PROB.
	115	113	113	113	113	114	114	118	115	115	115	115	115	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	261	237	239	243	245	246	249	252	254	256	259	261	263	-	FS.LOSS
	8	174	136	100	88	74	44	36	16	14	10	8	6	-	P. LOSS
	16	-154	-115	-80	-67	-53	-23	-14	6	9	13	16	17	-	S/N..DB
	90	0	0	0	0	0	0	0	52	69	84	90	93	-	S/N..PROB.
														86	=T.REL.
12	23.7														
	1F	2E	3F	3F	2E	2F	2X	1F	1F	1F	1F	1F	1F	-	MODE
	2	4	22	20	4	13	7	2	1	1	1	2	2	-	ANGLE
	50	99	99	99	99	99	99	99	99	95	78	46	13	-	PROB.
	115	113	124	123	114	118	115	115	114	114	115	115	115	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	261	237	241	242	244	246	249	252	254	256	259	261	263	-	FS.LOSS
	6	138	96	86	70	46	38	16	14	10	8	6	4	-	P. LOSS
	17	-118	-78	-66	-49	-26	-16	5	9	12	15	17	19	-	S/N..DB
	92	0	0	0	0	0	0	49	67	81	89	92	96	-	S/N..PROB.
														97	=T.REL.
14	23.1														
	1F	3F	3F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	-	MODE
	2	20	19	12	11	11	1	0	0	0	1	2	2	-	ANGLE
	50	99	99	99	99	99	99	99	98	93	73	38	9	-	PROB.
	115	123	122	118	117	117	114	114	114	114	115	115	115	-	DELAY
	172	156	158	159	161	162	164	166	166	169	171	173	174	-	NOISE
	260	237	239	242	244	246	249	252	254	256	259	261	263	-	FS.LOSS
	4	74	58	38	34	30	12	8	6	6	4	4	2	-	P. LOSS
	18	-55	-39	-20	-14	-10	7	11	14	15	17	18	19	-	S/N..DB
	98	0	0	0	1	2	62	83	92	95	97	98	99	-	S/N..PROB.
														99	=T.REL.
16	20.0														
	1F	1F	2F	2F	2F	2F	1F	1F	1F	1F	1F	1F	-	-	MODE
	2	0	11	11	11	11	0	0	1	1	2	2	-	-	ANGLE
	50	99	99	99	98	95	98	95	86	71	41	16	-	-	PROB.
	115	114	117	117	117	117	114	114	115	115	115	115	-	-	DELAY
	171	156	158	159	159	161	163	166	168	169	171	173	-	-	NOISE
	258	237	240	242	244	246	249	252	254	256	259	261	-	-	FS.LOSS
	2	14	22	20	18	16	4	4	2	2	2	2	-	-	P. LOSS
	20	4	-3	-1	-0	2	14	17	18	19	20	21	-	-	S/N..DB
	99	40	15	19	24	28	92	97	98	99	99	99	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	14.9														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	3	1	1	1	1	1	2	3	3	3	-	-	-	-	ANGLE
	50	99	99	99	98	96	85	63	36	15	-	-	-	-	PROB.
	116	114	114	115	115	115	115	116	116	116	-	-	-	-	DELAY
	167	154	155	157	159	161	164	166	168	169	-	-	-	-	NOISE
	253	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	-	-	-	-	P. LOSS
	17	2	5	7	10	12	15	17	18	19	-	-	-	-	S/N..DB
	97	29	44	62	79	88	95	97	98	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	12.2														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	4	2	2	2	2	3	4	4	4	-	-	-	-	-	ANGLE
	50	99	99	96	91	82	54	24	6	-	-	-	-	-	PROB.
	117	115	115	115	115	116	116	117	117	-	-	-	-	-	DELAY
	165	152	154	157	159	162	164	166	168	-	-	-	-	-	NOISE
	250	237	240	242	244	246	249	252	254	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	2	2	-	-	-	-	-	P. LOSS
	17	0	4	8	10	14	16	17	19	-	-	-	-	-	S/N..DB
	93	22	44	63	76	89	92	94	96	-	-	-	-	-	S/N..PROB.
														95	=T.REL.
22	11.3														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	5	2	2	3	3	4	5	5	-	-	-	-	-	-	ANGLE
	50	99	97	93	85	73	39	12	-	-	-	-	-	-	PROB.
	117	115	115	116	116	116	117	117	-	-	-	-	-	-	DELAY
	164	153	155	158	161	162	164	166	-	-	-	-	-	-	NOISE
	248	237	240	242	244	246	249	252	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	2	-	-	-	-	-	-	P. LOSS
	17	2	6	10	14	15	17	18	-	-	-	-	-	-	S/N..DB
	94	29	55	76	88	92	96	97	-	-	-	-	-	-	S/N..PROB.
														94	=T.REL.
24	10.8														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	5	2	2	3	3	4	5	-	-	-	-	-	-	-	ANGLE
	50	99	99	95	86	69	23	-	-	-	-	-	-	-	PROB.
	117	115	115	116	116	116	117	-	-	-	-	-	-	-	DELAY
	163	155	157	159	161	162	164	-	-	-	-	-	-	-	NOISE
	248	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	16	4	8	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	94	40	64	80	88	92	96	-	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.

27 MAR SSN= 100. 36.005
TO AZIMUTHS N.MILES
359.9 499.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	6.8														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	37	33	37	37	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	74	39	7	-	-	-	-	-	-	-	-	-	-	PROB.
	41	39	41	41	-	-	-	-	-	-	-	-	-	-	DELAY
	157	156	158	159	-	-	-	-	-	-	-	-	-	-	NOISE
	22[illegible]	218	222	224	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	35	34	35	36	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														85	=T.REL.
4	10.1														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	30	25	25	26	27	30	31	-	-	-	-	-	-	-	ANGLE
	50	99	99	93	78	53	7	-	-	-	-	-	-	-	PROB.
	38	35	35	36	36	37	38	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	227	217	219	222	224	226	230	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	3	6	4	4	-	-	-	-	-	-	-	P. LOSS
	36	27	31	33	35	36	38	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	14.6														
	1F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	28	42	25	23	23	23	24	26	29	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	90	61	22	-	-	-	-	-	PROB.
	37	43	35	35	35	35	35	36	37	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	232	215	219	221	223	225	228	231	234	-	-	-	-	-	FS.LOSS
	6	58	28	22	18	16	10	8	6	-	-	-	-	-	P. LOSS
	36	-15	14	18	23	27	32	35	38	-	-	-	-	-	S/N..DB
	99	0	93	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	15.7														
	1F	2F	1E	1F	1F	1E	1F	1F	1F	1F	-	-	-	-	MODE
	28	41	12	24	23	14	23	25	28	28	-	-	-	-	ANGLE
	50	99	99	99	99	99	91	73	44	14	-	-	-	-	PROB.
	36	43	32	35	35	33	35	35	37	37	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	234	215	216	221	223	225	228	231	234	236	-	-	-	-	FS.LOSS
	8	84	64	32	26	22	16	12	8	6	-	-	-	-	P. LOSS
	35	-42	-21	9	15	20	27	31	35	37	-	-	-	-	S/N..DB
	99	0	0	76	96	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	15.5														
	1F	2F	1E	1F	1F	1E	1F	1F	1F	1F	-	-	-	-	MODE
	30	44	12	26	25	14	25	27	30	30	-	-	-	-	ANGLE
	50	99	99	99	99	99	91	72	42	13	-	-	-	-	PROB.
	37	44	32	36	35	32	35	36	37	37	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	234	220	218	222	223	225	229	232	235	237	-	-	-	-	FS.LOSS
	8	82	68	32	26	22	16	12	8	6	-	-	-	-	P. LOSS
	35	-45	-24	9	15	20	26	31	35	36	-	-	-	-	S/N..DB
	99	0	0	76	96	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	14.9														
	1F	1E	1F	1F	1E	1F	1F	1F	1F	-	-	-	-	-	MODE
	30	12	26	25	14	24	25	27	30	-	-	-	-	-	ANGLE
	50	99	99	99	99	96	85	63	22	-	-	-	-	-	PROB.
	37	32	36	35	32	35	35	36	37	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	233	215	219	221	223	225	229	232	235	-	-	-	-	-	FS.LOSS
	8	70	30	26	22	18	12	8	6	-	-	-	-	-	P. LOSS
	35	-26	10	15	21	24	30	34	37	-	-	-	-	-	S/N..DB
	99	0	78	96	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	14.6														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	29	24	23	23	23	23	24	27	29	-	-	-	-	-	ANGLE
	50	99	99	99	98	95	83	58	15	-	-	-	-	-	PROB.
	37	35	35	35	35	35	35	36	37	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	233	216	219	221	223	225	228	232	234	-	-	-	-	-	FS.LOSS
	4	22	18	14	12	10	6	4	4	-	-	-	-	-	P. LOSS
	39	19	24	27	31	33	36	38	40	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	12.5														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	30	22	23	23	24	25	28	30	-	-	-	-	-	-	ANGLE
	50	99	99	97	93	86	58	18	-	-	-	-	-	-	PROB.
	37	35	35	35	35	35	37	37	-	-	-	-	-	-	DELAY
	164	156	158	159	159	161	163	166	-	-	-	-	-	-	NOISE
	230	216	219	221	223	225	229	232	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	2	2	-	-	-	-	-	-	P. LOSS
	40	35	37	38	37	39	39	41	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	9.3														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	33	26	27	29	31	33	-	-	-	-	-	-	-	-	ANGLE
	50	97	91	78	57	29	-	-	-	-	-	-	-	-	PROB.
	39	36	36	37	38	39	-	-	-	-	-	-	-	-	DELAY
	160	154	155	157	159	161	-	-	-	-	-	-	-	-	NOISE
	226	217	220	222	225	227	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	4	2	2	-	-	-	-	-	-	-	-	P. LOSS
	37	33	35	35	36	37	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	8.1														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	35	30	31	35	35	35	-	-	-	-	-	-	-	-	ANGLE
	50	91	75	52	25	8	-	-	-	-	-	-	-	-	PROB.
	40	37	38	40	40	40	-	-	-	-	-	-	-	-	DELAY
	157	152	154	157	159	162	-	-	-	-	-	-	-	-	NOISE
	224	217	220	224	226	228	-	-	-	-	-	-	-	-	FS.LOSS
	2	4	4	2	2	2	-	-	-	-	-	-	-	-	P. LOSS
	34	31	32	34	36	38	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														98	=T.REL.
22	7.7														
	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	MODE
	37	32	34	37	37	-	-	-	-	-	-	-	-	-	ANGLE
	50	87	68	41	16	-	-	-	-	-	-	-	-	-	PROB.
	41	38	39	41	41	-	-	-	-	-	-	-	-	-	DELAY
	157	153	155	158	161	-	-	-	-	-	-	-	-	-	NOISE
	223	218	221	224	226	-	-	-	-	-	-	-	-	-	FS.LOSS
	2	4	4	2	2	-	-	-	-	-	-	-	-	-	P. LOSS
	34	32	33	35	37	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	-	-	-	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.
24	7.4														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	37	32	35	37	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	87	63	27	-	-	-	-	-	-	-	-	-	-	PROB.
	41	38	40	41	-	-	-	-	-	-	-	-	-	-	DELAY
	158	155	157	159	-	-	-	-	-	-	-	-	-	-	NOISE
	223	218	221	224	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	2	4	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	35	33	35	36	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.

31 MAR SSN= 10C. 36.01C
TO AZIMUTHS N.MILES
359.9 1000.3
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	9.5														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	18	13	14	15	16	18	-	-	-	-	-	-	-	-	ANGLE
	50	98	93	81	62	34	-	-	-	-	-	-	-	-	PROB.
	69	66	67	67	68	69	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	236	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	2	-	-	-	-	-	-	-	-	P. LOSS
	28	21	24	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	14.8														
	1F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	14	26	13	11	11	11	11	13	14	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	90	64	26	-	-	-	-	-	PROB.
	67	71	66	66	65	65	66	66	67	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	243	227	230	232	234	236	239	242	245	-	-	-	-	-	FS.LOSS
	4	32	16	14	12	10	6	4	4	-	-	-	-	-	P. LOSS
	28	-0	14	17	20	22	25	27	29	-	-	-	-	-	S/N..DB
	99	20	93	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	21.7														
	1F	3F	2F	2F	1E	1E	1F	1F	1F	1F	1F	1F	-	-	MODE
	13	34	25	24	3	3	10	10	10	10	12	13	-	-	ANGLE
	50	99	99	99	99	99	99	99	96	88	59	22	-	-	PROB.
	66	78	71	70	63	63	65	65	65	65	66	66	-	-	DELAY
	172	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	250	226	229	232	234	235	239	242	244	246	249	251	-	-	FS.LOSS
	6	80	62	50	40	34	18	14	10	8	6	4	-	-	P. LOSS
	29	-49	-30	-17	-7	-0	14	19	22	25	28	30	-	-	S/N..DB
	99	0	0	0	4	20	95	99	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.
8	23.8														
	1F	3F	1E	1E	1E	1E	1E	1E	1F	1F	1F	1F	1F	1F	MODE
	13	35	3	3	3	3	3	4	10	10	11	13	13	13	ANGLE
	50	99	99	99	99	99	99	99	95	89	72	48	21	6	PROB.
	66	78	63	63	63	63	63	63	65	65	65	66	66	66	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	251	226	229	232	234	235	239	242	244	246	249	251	254	255	FS.LOSS
	6	114	88	70	58	48	34	20	16	12	8	6	6	4	P. LOSS
	28	-83	-57	-39	-25	-15	-1	13	18	21	25	28	29	31	S/N..DB
	99	0	0	0	0	0	18	92	99	99	99	99	99	99	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	23.6														
	1F	3F	2F	1E	1E	1E	1F	1E	1F	1F	1F	1F	1F	-	MODE
	13	37	27	3	3	3	12	4	10	10	11	14	14	-	ANGLE
	50	99	99	99	99	99	99	99	94	88	71	46	19	-	PROB.
	66	80	72	63	63	63	66	63	65	65	66	66	66	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	251	226	232	232	234	235	239	242	244	246	249	252	254	-	FS.LOSS
	6	120	84	74	60	50	24	20	16	12	10	6	6	-	P. LOSS
	28	-89	-53	-42	-27	-17	7	13	17	21	25	28	29	-	S/N..DB
	99	0	0	0	0	0	63	92	98	99	99	99	99	-	S/N..PROB.
														99	=T.REL.
12	22.8														
	1F	3F	2F	2F	1E	1E	1F	1F	1F	1F	1F	1F	-	-	MODE
	13	35	26	25	3	3	11	10	10	10	12	13	-	-	ANGLE
	50	99	99	99	99	99	99	98	94	87	66	30	-	-	PROB.
	66	79	71	71	63	63	65	65	65	65	66	66	-	-	DELAY
	172	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	251	226	231	232	234	235	239	242	244	246	249	252	-	-	FS.LOSS
	6	94	70	58	48	40	20	16	12	10	6	6	-	-	P. LOSS
	28	-63	-40	-26	-14	-6	12	17	21	23	27	29	-	-	S/N..DB
	99	0	0	0	0	5	89	98	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.
14	22.5														
	1F	2F	2F	1E	1F	1F	1F	1F	1F	1F	1F	1F	-	-	MODE
	13	24	23	3	11	10	9	9	10	10	11	13	-	-	ANGLE
	50	99	99	99	99	99	99	98	94	86	64	26	-	-	PROB.
	66	70	70	63	66	65	65	65	65	65	66	66	-	-	DELAY
	172	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	250	227	229	232	234	236	239	242	244	246	249	251	-	-	FS.LOSS
	2	48	36	30	16	14	12	8	6	6	4	2	-	-	P. LOSS
	31	-16	-5	2	14	17	21	24	27	28	30	32	-	-	S/N..DB
	99	0	6	29	94	98	99	99	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.
16	19.5														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	MODE
	14	9	9	9	9	9	10	10	11	12	14	14	-	-	ANGLE
	50	99	99	99	99	99	98	93	82	65	31	7	-	-	PROB.
	67	65	65	65	65	65	65	65	65	66	67	67	-	-	DELAY
	170	156	158	159	159	161	163	166	168	169	171	173	-	-	NOISE
	248	227	230	232	234	236	239	242	244	246	249	252	-	-	FS.LOSS
	2	10	8	6	6	4	4	2	2	2	0	0	-	-	P. LOSS
	32	19	22	24	24	26	28	30	31	32	33	34	-	-	S/N..DB
	99	99	98	99	99	99	99	99	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	14.2														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	16	11	11	11	11	12	13	15	16	-	-	-	-	-	ANGLE
	50	99	99	99	97	93	78	53	21	-	-	-	-	-	PROB.
	67	65	65	65	66	66	66	67	67	-	-	-	-	-	DELAY
	166	154	155	157	159	161	164	166	168	-	-	-	-	-	NOISE
	243	227	230	232	234	236	239	242	245	-	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	2	-	-	-	-	-	P. LOSS
	30	18	21	22	24	26	29	30	31	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	11.7														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	17	12	13	13	14	14	17	17	-	-	-	-	-	-	ANGLE
	50	99	97	93	87	76	46	19	-	-	-	-	-	-	PROB.
	68	66	66	66	67	67	68	68	-	-	-	-	-	-	DELAY
	164	152	154	157	159	162	164	166	-	-	-	-	-	-	NOISE
	240	227	230	232	235	236	240	243	-	-	-	-	-	-	FS.LOSS
	2	8	6	6	4	4	2	2	-	-	-	-	-	-	P. LOSS
	29	17	19	23	25	27	29	30	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	11.0														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	19	14	14	15	15	16	19	19	-	-	-	-	-	-	ANGLE
	50	98	96	90	80	67	34	10	-	-	-	-	-	-	PROB.
	69	67	67	67	67	68	69	69	-	-	-	-	-	-	DELAY
	163	153	155	158	161	162	164	166	-	-	-	-	-	-	NOISE
	239	228	230	233	235	237	240	243	-	-	-	-	-	-	FS.LOSS
	2	8	6	4	4	4	2	2	-	-	-	-	-	-	P. LOSS
	28	18	21	24	27	27	29	30	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	10.5														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	19	14	14	15	16	17	19	-	-	-	-	-	-	-	ANGLE
	50	99	97	91	78	60	11	-	-	-	-	-	-	-	PROB.
	69	67	67	67	68	68	69	-	-	-	-	-	-	-	DELAY
	163	155	157	159	161	162	164	-	-	-	-	-	-	-	NOISE
	238	228	230	233	235	237	240	-	-	-	-	-	-	-	FS.LOSS
	2	8	6	4	4	4	2	-	-	-	-	-	-	-	P. LOSS
	28	20	23	25	27	27	29	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

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35              MAR                SSN= 100.              36.018
                TO                                AZIMUTHS        N.MILES
                                                     36C.0         1800.9
SIGMA= 1000 SQ. METERS                                           ANT= 25DB
OFF AZIMUTH    0 DEG.     MIN. ANGLE= -0 DEG.    OFF AZIMUTH    0 DEG.
PWR=200.00KW          3 MC/S MAN. NOISE = -148 DBW        REQ.S/N=   6DB
                           OPERATING FREQUENCIES
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GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	11.3														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	5	2	3	3	3	4	5	-	-	-	-	-	-	-	ANGLE
	50	99	98	95	87	74	30	-	-	-	-	-	-	-	PROB.
	117	116	116	116	116	116	117	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	248	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	17	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	97	46	71	84	92	94	98	-	-	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
4	16.8														
	1F	2F	2F	2X	2F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	3	15	14	9	14	2	2	2	3	3	-	-	-	-	ANGLE
	50	99	99	99	95	99	97	87	62	29	-	-	-	-	PROB.
	116	121	119	116	119	115	115	115	116	116	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	255	238	240	243	245	246	249	252	254	256	-	-	-	-	FS.LOSS
	4	42	36	30	26	12	8	6	6	4	-	-	-	-	P. LOSS
	16	-24	-17	-12	-7	8	11	14	16	17	-	-	-	-	S/N..DB
	97	0	0	1	4	68	85	94	97	98	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	24.1														
	1F	2E	3F	3F	2F	2F	2X	1F	1F	1F	1F	1F	1F	-	MODE
	3	4	22	21	14	13	7	2	1	1	2	3	2	-	ANGLE
	50	99	99	99	99	99	99	99	99	96	80	51	18	-	PROB.
	116	113	125	124	120	119	115	115	115	115	115	116	115	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	261	237	241	243	245	246	250	252	254	256	259	261	263	-	FS.LOSS
	6	138	96	84	52	46	36	16	12	10	8	6	4	-	P. LOSS
	17	-118	-77	-65	-32	-26	-16	4	9	11	14	17	18	-	S/N..DB
	98	0	0	0	0	0	0	41	73	85	94	98	99	-	S/N..PROB.
														98	=T.REL.
8	27.5														
	1F	2E	2E	2E	2E	2E	2E	2X	1F	1F	1F	1F	1F	1F	MODE
	3	4	4	4	4	4	5	6	2	1	1	2	2	2	ANGLE
	50	99	99	99	99	99	99	92	98	96	88	74	54	29	PROB.
	116	113	113	113	113	114	114	114	115	115	115	115	115	116	DELAY
	174	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	[illegible]	237	239	243	245	246	250	252	254	256	259	261	263	265	FS.LOSS
	6	194	150	106	94	82	48	38	18	14	12	8	6	6	P. LOSS
	16	-174	-130	-88	-74	-61	-27	-18	3	7	11	14	16	18	S/N..DB
	97	0	0	0	0	0	0	0	33	62	83	92	96	98	S/N..PROB.
														92	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	28.9														
	1F	2E	2E	3F	2E	2E	2E	2X	1F	1F	1F	1F	1F	1F	MODE
	3	4	4	22	4	4	5	7	2	1	1	2	2	3	ANGLE
	50	99	99	99	99	99	99	95	99	97	91	80	63	41	PROB.
	116	113	113	125	113	114	114	115	115	115	115	115	115	116	DELAY
	175	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	264	237	239	243	245	247	250	252	254	256	259	261	263	265	FS.LOSS
	6	202	156	108	96	84	48	40	18	16	12	8	8	6	P. LOSS
	18	-182	-136	-89	-75	-64	-28	-18	3	7	11	15	16	19	S/N..DB
	94	0	0	0	0	0	0	0	37	59	76	88	91	95	S/N..PROB.
														93	=T.REL.
12	28.7														
	1F	2E	3F	3F	2E	2F	2X	2F	1F	1F	1F	1F	1F	1F	MODE
	3	4	23	21	4	14	7	12	1	1	1	2	2	3	ANGLE
	50	99	99	99	99	99	99	95	99	98	92	81	62	32	PROB.
	116	113	126	124	113	119	115	118	115	115	115	115	115	116	DELAY
	175	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	264	237	241	243	244	247	250	252	254	256	259	261	263	265	FS.LOSS
	4	160	106	92	82	52	40	34	16	12	10	8	6	4	P. LOSS
	19	-140	-86	-73	-60	-31	-20	-12	7	10	14	16	18	20	S/N..DB
	96	0	0	0	0	0	0	1	57	73	86	90	95	96	S/N..PROB.
														97	=T.REL.
14	27.9														
	1F	3F	3F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	1F	MODE
	3	22	20	13	12	12	2	1	1	1	1	1	2	3	ANGLE
	50	99	99	99	99	99	99	99	99	97	91	77	57	23	PROB.
	116	124	123	119	118	118	115	114	114	114	115	115	115	116	DELAY
	175	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	264	238	239	243	245	246	249	252	254	256	259	261	263	265	FS.LOSS
	2	30	66	42	36	32	14	10	8	6	4	4	2	2	P. LOSS
	20	-64	-47	-24	-18	-13	6	9	12	14	16	18	19	20	S/N..DB
	99	0	0	0	0	1	56	73	86	93	96	98	99	99	S/N..PROB.
														99	=T.REL.
16	24.1														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	MODE
	3	1	0	0	0	0	0	1	1	1	2	3	3	3	ANGLE
	50	99	99	99	99	99	99	98	96	90	75	51	22	6	PROB.
	116	114	114	114	114	114	114	114	115	115	115	116	116	116	DELAY
	173	156	158	159	159	161	163	166	168	169	171	173	174	175	NOISE
	261	237	240	242	244	246	249	252	254	256	259	261	263	265	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	2	2	0	0	P. LOSS
	21	4	7	9	10	12	14	17	18	19	20	21	21	22	S/N..DB
	99	40	56	66	76	82	92	97	98	99	99	99	99	99	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	17.7														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	4	1	1	1	1	2	2	2	3	4	4	-	-	-	ANGLE
	50	99	99	99	99	99	95	86	69	46	12	-	-	-	PROB.
	117	115	115	115	115	115	115	115	116	117	117	-	-	-	DELAY
	169	154	155	157	159	161	164	166	168	169	171	-	-	-	NOISE
	256	237	240	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	2	-	-	-	P. LOSS
	19	1	5	7	10	12	15	17	18	18	20	-	-	-	S/N..DB
	99	24	44	62	79	88	95	97	98	98	99	-	-	-	S/N..PROB.
														99	=T.REL.
20	14.4														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	5	2	2	2	3	3	3	5	5	5	-	-	-	-	ANGLE
	50	99	99	98	96	92	78	55	30	12	-	-	-	-	PROB.
	117	115	115	115	116	116	116	117	117	117	-	-	-	-	DELAY
	167	152	154	157	159	162	164	166	168	169	-	-	-	-	NOISE
	252	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	2	2	2	-	-	-	-	P. LOSS
	18	0	4	8	10	14	16	17	19	19	-	-	-	-	S/N..DB
	94	22	44	63	76	89	92	94	96	96	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	13.2														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	6	3	3	3	3	4	5	6	6	-	-	-	-	-	ANGLE
	50	99	99	97	94	88	67	40	17	-	-	-	-	-	PROB.
	118	116	116	116	116	116	117	118	118	-	-	-	-	-	DELAY
	166	153	155	158	161	162	164	166	168	-	-	-	-	-	NOISE
	251	237	240	242	244	246	249	252	254	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	2	2	-	-	-	-	-	P. LOSS
	19	2	6	10	14	15	17	18	20	-	-	-	-	-	S/N..DB
	97	29	55	76	88	92	96	97	98	-	-	-	-	-	S/N..PROB.
														98	=T.REL.
24	12.4														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	6	3	3	3	3	4	5	6	-	-	-	-	-	-	ANGLE
	50	99	99	98	94	86	57	14	-	-	-	-	-	-	PROB.
	118	116	116	116	116	116	117	118	-	-	-	-	-	-	DELAY
	165	155	157	159	161	162	164	166	-	-	-	-	-	-	NOISE
	250	237	240	242	244	246	249	252	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	2	-	-	-	-	-	-	P. LOSS
	18	4	8	11	14	15	17	18	-	-	-	-	-	-	S/N..DB
	96	40	64	80	88	92	96	97	-	-	-	-	-	-	S/N..PROB.
														98	=T.REL.

27 DEC SSN= 10. 36.005
TO AZIMUTHS N.MILES
359.9 499.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	5.7														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	31	31	31	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	38	8	-	-	-	-	-	-	-	-	-	-	-	PROB.
	38	38	38	-	-	-	-	-	-	-	-	-	-	-	DELAY
	155	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	218	220	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	35	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
4	6.1														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	28	28	29	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	56	7	-	-	-	-	-	-	-	-	-	-	-	PROB.
	37	36	37	-	-	-	-	-	-	-	-	-	-	-	DELAY
	156	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	217	220	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	6	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	35	35	37	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														60	=T.REL.
6	9.9														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	23	21	20	21	21	24	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	95	77	44	-	-	-	-	-	-	-	-	PROB.
	35	34	34	34	34	35	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	225	216	218	221	223	225	-	-	-	-	-	-	-	-	FS.LOSS
	6	16	12	10	8	6	-	-	-	-	-	-	-	-	P. LOSS
	36	25	29	32	35	36	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	9.7														
	1F	1E	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	22	12	21	21	21	23	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	96	76	36	-	-	-	-	-	-	-	-	PROB.
	35	32	34	34	34	35	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	224	215	219	221	223	225	-	-	-	-	-	-	-	-	FS.LOSS
	12	38	20	16	14	10	-	-	-	-	-	-	-	-	P. LOSS
	32	4	21	25	29	32	-	-	-	-	-	-	-	-	S/N..DB
	99	39	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

		OPERATING FREQUENCIES													
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	9.3														
	1F	1E	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	22	12	22	21	22	23	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	91	62	18	-	-	-	-	-	-	-	-	PROB.
	35	32	34	34	34	35	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	224	215	219	221	223	225	-	-	-	-	-	-	-	-	FS.LOSS
	12	40	22	18	14	10	-	-	-	-	-	-	-	-	P. LOSS
	29	1	20	24	29	31	-	-	-	-	-	-	-	-	S/N..DB
	99	20	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	9.0														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	22	22	20	21	22	23	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	90	50	10	-	-	-	-	-	-	-	-	PROB.
	35	34	34	34	35	35	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	223	216	218	221	223	225	-	-	-	-	-	-	-	-	FS.LOSS
	10	20	16	12	10	8	-	-	-	-	-	-	-	-	P. LOSS
	33	21	26	29	33	34	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	7.1														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	24	21	23	24	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	97	59	8	-	-	-	-	-	-	-	-	-	-	PROB.
	35	34	35	35	-	-	-	-	-	-	-	-	-	-	DELAY
	158	156	158	159	-	-	-	-	-	-	-	-	-	-	NOISE
	219	216	219	221	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	6	4	4	-	-	-	-	-	-	-	-	-	-	P. LOSS
	37	35	37	38	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	5.3														
	1F	1F	-	-	-	-	-	-	-	-	-	-	-	-	MODE
	27	28	-	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	22	-	-	-	-	-	-	-	-	-	-	-	-	PROB.
	36	36	-	-	-	-	-	-	-	-	-	-	-	-	DELAY
	154	156	-	-	-	-	-	-	-	-	-	-	-	-	NOISE
	215	217	-	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	4	-	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	35	-	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	-	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.

GMT	MUF						OPERATING FREQUENCIES								
		6	7	8	9	10	12	14	16	18	21	24	27	30	
18	5.4														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	30	30	30	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	27	5	-	-	-	-	-	-	-	-	-	-	-	PROB.
	37	38	38	-	-	-	-	-	-	-	-	-	-	-	DELAY
	155	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	216	218	220	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	35	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
20	5.3														
	1F	1F	-	-	-	-	-	-	-	-	-	-	-	-	MODE
	32	32	-	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	25	-	-	-	-	-	-	-	-	-	-	-	-	PROB.
	38	38	-	-	-	-	-	-	-	-	-	-	-	-	DELAY
	154	155	-	-	-	-	-	-	-	-	-	-	-	-	NOISE
	216	218	-	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	4	-	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	34	-	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	-	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
22	5.6														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	33	33	33	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	34	8	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	39	-	-	-	-	-	-	-	-	-	-	-	DELAY
	155	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
24	6.0														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	32	32	32	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	49	14	-	-	-	-	-	-	-	-	-	-	-	PROB.
	38	38	38	-	-	-	-	-	-	-	-	-	-	-	DELAY
	156	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	218	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	35	35	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														57	=T.REL.

```
        31          DEC                SSN=  10.                  36.010
                     TO                            AZIMUTHS        N.MILES
                                                      359.9        1000.3
SIGMA= 1000 SQ. METERS                                           ANT= 25DB
OFF AZIMUTH    0 DEG.      MIN. ANGLE= -0 D°G.    OFF AZIMUTH    0 DEG.
PWR=200.00KW          3 MC/S MAN. NOISE = -148 DBW        REQ.S/N=   6DB
                          OPERATING FREQUENCIES
```

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	8.6														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	15	11	12	13	15	15	-	-	-	-	-	-	-	-	ANGLE
	50	96	86	66	40	17	-	-	-	-	-	-	-	-	PROB.
	67	65	66	66	67	67	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	232	235	236	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	20	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	8.8														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	13	10	10	11	13	13	-	-	-	-	-	-	-	-	ANGLE
	50	99	93	74	41	13	-	-	-	-	-	-	-	-	PROB.
	66	65	65	66	66	66	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	232	234	236	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	20	23	24	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	15.3														
	1F	2F	1E	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	10	21	3	9	8	8	8	9	10	10	-	-	-	-	ANGLE
	50	99	99	99	99	99	95	75	37	8	-	-	-	-	PROB.
	65	68	63	65	64	64	64	65	65	65	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	243	227	229	232	234	236	239	242	244	246	-	-	-	-	FS.LOSS
	4	28	22	14	12	10	6	6	4	2	-	-	-	-	P. LOSS
	29	2	10	17	20	22	25	27	30	30	-	-	-	-	S/N..DB
	99	26	78	99	99	99	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	16.3														
	1F	2F	2F	1E	1E	1F	1F	1F	1F	1F	-	-	-	-	MODE
	10	23	21	3	3	9	8	8	9	10	-	-	-	-	ANGLE
	50	99	99	99	99	99	99	89	56	13	-	-	-	-	PROB.
	65	69	68	63	63	65	64	64	65	65	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	244	227	229	232	234	236	239	242	244	246	-	-	-	-	FS.LOSS
	6	50	38	30	24	16	12	10	6	6	-	-	-	-	P. LOSS
	27	-18	-6	1	7	16	20	23	27	28	-	-	-	-	S/N..DB
	99	0	5	23	60	97	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	15.5														
	1F	2F	1E	1E	1E	1F	1F	1F	1F	-	-	-	-	-	MODE
	10	23	3	3	3	10	8	8	9	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	97	79	35	-	-	-	-	-	PROB.
	65	70	63	63	63	65	64	64	65	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	243	227	229	232	234	236	239	242	244	-	-	-	-	-	FS.LOSS
	8	52	40	32	26	16	12	10	8	-	-	-	-	-	P. LOSS
	25	-21	-9	-0	6	15	19	23	26	-	-	-	-	-	S/N..DB
	99	0	2	21	53	96	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	14.7														
	1F	2F	1E	1E	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	10	21	3	3	9	8	8	9	10	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	93	65	18	-	-	-	-	-	PROB.
	65	68	63	63	65	64	64	65	65	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	243	227	229	232	234	236	239	242	244	-	-	-	-	-	FS.LOSS
	6	36	28	22	14	12	10	6	4	-	-	-	-	-	P. LOSS
	27	-5	3	9	17	19	23	26	28	-	-	-	-	-	S/N..DB
	99	7	31	76	98	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	11.5														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	11	8	8	8	8	9	11	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	96	85	31	-	-	-	-	-	-	-	PROB.
	65	64	64	64	64	65	65	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	238	227	230	232	234	236	239	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	6	4	2	-	-	-	-	-	-	-	P. LOSS
	29	19	22	24	26	27	29	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	8.3														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	12	9	10	11	13	13	-	-	-	-	-	-	-	-	ANGLE
	50	93	81	59	34	15	-	-	-	-	-	-	-	-	PROB.
	66	65	65	66	66	66	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	233	227	230	232	234	236	-	-	-	-	-	-	-	-	FS.LOSS
	6	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	20	23	24	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

		OPERATING FREQUENCIES													
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	8.6														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	14	11	11	12	14	14	-	-	-	-	-	-	-	-	ANGLE
	50	95	84	65	41	20	-	-	-	-	-	-	-	-	PROB.
	67	65	65	66	67	67	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	232	235	236	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	20	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	8.6														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	15	12	12	13	15	15	-	-	-	-	-	-	-	-	ANGLE
	50	97	87	67	41	20	-	-	-	-	-	-	-	-	PROB.
	67	66	66	66	67	67	-	-	-	-	-	-	-	-	DELAY
	160	155	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	232	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	6	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	19	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	8.8														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	16	12	13	14	16	16	-	-	-	-	-	-	-	-	ANGLE
	50	97	90	72	46	25	-	-	-	-	-	-	-	-	PROB.
	67	66	66	66	67	67	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	232	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	6	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	21	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	9.3														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	15	11	12	13	14	15	-	-	-	-	-	-	-	-	ANGLE
	50	98	92	78	56	31	-	-	-	-	-	-	-	-	PROB.
	67	65	66	66	67	67	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	235	227	230	232	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	20	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

35 DEC SSN= 10. 36.018

TO AZIMUTHS N.MILES

360.0 1800.9

SIGMA= 1000 SQ. METERS ANT= 25DB

OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.

PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	9.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	4	2	2	2	3	3	-	-	-	-	-	-	-	-	ANGLE
	50	98	93	80	59	34	-	-	-	-	-	-	-	-	PROB.
	116	115	115	115	116	116	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	245	237	240	242	244	246	-	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	-	-	-	-	-	-	-	-	P. LOSS
	14	5	9	11	14	15	-	-	-	-	-	-	-	-	S/N..DB
	95	46	73	86	94	96	-	-	-	-	-	-	-	-	S/N..PROB.
														90	=T.REL.
4	8.6														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	3	1	2	2	3	3	-	-	-	-	-	-	-	-	ANGLE
	50	99	92	71	36	10	-	-	-	-	-	-	-	-	PROB.
	116	115	115	115	116	116	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	243	237	240	242	244	246	-	-	-	-	-	-	-	-	FS.LOSS
	8	14	10	8	6	6	-	-	-	-	-	-	-	-	P. LOSS
	12	5	9	11	13	14	-	-	-	-	-	-	-	-	S/N..DB
	85	47	69	81	86	90	-	-	-	-	-	-	-	-	S/N..PROB.
														76	=T.REL.
6	16.3														
	1F	2F	2F	2F	1F	2F	2F	1F	1F	1F	-	-	-	-	MODE
	1	12	11	11	0	11	13	0	1	1	-	-	-	-	ANGLE
	50	99	99	99	99	90	52	85	55	20	-	-	-	-	PROB.
	115	118	117	117	114	117	119	114	115	115	-	-	-	-	DELAY
	168	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	254	237	240	242	244	246	250	252	254	256	-	-	-	-	FS.LOSS
	4	34	30	26	10	20	16	4	4	4	-	-	-	-	P. LOSS
	18	-16	-10	-5	10	0	3	17	18	19	-	-	-	-	S/N..DB
	97	0	2	8	74	21	37	96	97	98	-	-	-	-	S/N..PROB.
														97	=T.REL.
8	20.2														
	1F	3F	3F	2F	2F	2F	2F	2F	2F	-	1F	-	-	-	MODE
	1	19	17	11	10	10	10	11	12	-	1	-	-	-	ANGLE
	50	99	99	99	99	99	97	76	30	-	34	-	-	-	PROB.
	114	121	120	117	117	116	116	117	118	-	114	-	-	-	DELAY
	171	156	158	159	161	162	164	166	168	-	171	-	-	-	NOISE
	258	237	240	242	244	246	249	252	254	-	259	-	-	-	FS.LOSS
	4	74	56	40	34	30	24	20	18	-	4	-	-	-	P. LOSS
	20	-53	-34	-19	-13	-8	-1	2	5	-	20	-	-	-	S/N..DB
	99	0	0	0	0	3	17	29	46	-	99	-	-	-	S/N..PROB.
														50	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	20.1														
	1F	3F	3F	2F	2F	2F	2F	2F	2F	-	1F	-	-	-	MODE
	1	19	17	12	10	10	10	11	12	-	1	-	-	-	ANGLE
	50	99	99	99	99	99	96	75	28	-	32	-	-	-	PROB.
	114	122	120	118	117	116	116	117	118	-	114	-	-	-	DELAY
	171	156	158	159	161	162	164	166	168	-	171	-	-	-	NOISE
	258	237	240	242	244	246	249	252	254	-	259	-	-	-	FS.LOSS
	4	80	60	42	36	32	26	20	18	-	4	-	-	-	P. LOSS
	19	-59	-38	-21	-15	-10	-3	1	5	-	19	-	-	-	S/N..DB
	99	0	0	0	0	2	12	22	45	-	99	-	-	-	S/N..PROB.
														50	=T.REL.
12	18.1														
	1F	3F	2F	2F	2F	2F	2F	2F	1F	1F	-	-	-	-	MODE
	1	17	11	10	10	10	11	12	0	1	-	-	-	-	ANGLE
	50	99	99	99	99	98	82	37	82	51	-	-	-	-	PROB.
	115	120	117	117	116	116	117	118	114	115	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	256	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	4	52	36	32	28	24	20	16	6	4	-	-	-	-	P. LOSS
	19	-32	-16	-11	-5	-2	2	5	18	19	-	-	-	-	S/N..DB
	99	0	0	1	6	14	28	48	99	99	-	-	-	-	S/N..PROB.
														87	=T.REL.
14	13.1														
	1F	2F	2F	2F	2F	1F	1F	1F	-	-	-	-	-	-	MODE
	1	10	10	11	12	0	1	1	-	-	-	-	-	-	ANGLE
	50	99	99	92	73	97	75	23	-	-	-	-	-	-	PROB.
	115	117	117	117	118	114	114	115	-	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	251	237	240	242	244	246	249	252	-	-	-	-	-	-	FS.LOSS
	4	26	22	20	18	6	4	4	-	-	-	-	-	-	P. LOSS
	18	-7	-2	0	3	15	17	18	-	-	-	-	-	-	S/N..DB
	99	4	12	18	32	96	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	9.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	2	1	1	1	2	2	2	-	-	-	-	-	-	-	ANGLE
	50	97	90	76	55	33	6	-	-	-	-	-	-	-	PROB.
	115	114	115	115	115	115	115	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	245	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	13	5	9	10	13	14	16	-	-	-	-	-	-	-	S/N..DB
	92	46	73	82	91	94	98	-	-	-	-	-	-	-	S/N..PROB.
														83	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	9.5														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	3	1	1	2	3	3	3	-	-	-	-	-	-	-	ANGLE
	50	97	92	80	61	39	9	-	-	-	-	-	-	-	PROB.
	116	115	115	115	116	116	116	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	245	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	13	5	9	10	13	14	16	-	-	-	-	-	-	-	S/N..DB
	93	46	73	82	91	94	98	-	-	-	-	-	-	-	S/N..PROB.
														86	=T.REL.
20	9.9														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	2	3	4	4	-	-	-	-	-	-	-	ANGLE
	50	99	96	87	70	47	13	-	-	-	-	-	-	-	PROB.
	116	115	115	115	116	116	116	-	-	-	-	-	-	-	DELAY
	162	155	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	246	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	14	4	9	11	13	14	16	-	-	-	-	-	-	-	S/N..DB
	93	42	72	85	90	94	97	-	-	-	-	-	-	-	S/N..PROB.
														93	=T.REL.
22	10.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	2	3	3	4	-	-	-	-	-	-	-	ANGLE
	50	99	97	91	77	56	19	-	-	-	-	-	-	-	PROB.
	116	115	115	115	116	116	116	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	246	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	15	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	96	46	72	85	93	95	98	-	-	-	-	-	-	-	S/N..PROB.
														95	=T.REL.
24	10.5														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	1	2	2	2	3	3	-	-	-	-	-	-	-	ANGLE
	50	99	97	91	79	60	19	-	-	-	-	-	-	-	PROB.
	116	115	115	115	115	116	116	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	16	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	96	46	72	85	93	95	98	-	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.

27 DEC SSN= 50. 36.005

TO AZIMUTHS N.MILES

359.9 499.9

SIGMA= 1000 SQ. METERS ANT= 2508

OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.

PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 60B

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	5.7														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	33	33	33	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	38	8	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	39	-	-	-	-	-	.	-	-	-	-	-	DELAY
	155	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	218	221	-	-	-	-	.	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-		-	-	-	-	-	-	P. LOSS
	34	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
4	6.5														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	30	27	30	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	74	22	-	-	-	-	-	-	-	-	-	-	-	PROB.
	37	36	37	-	-	-	-	-	-	-	-	-	-	-	DELAY
	157	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	219	217	220	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	6	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	36	35	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														80	=T.REL.
6	11.9														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	25	22	21	21	21	22	26	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	98	91	46	-	-	-	-	-	-	-	PROB.
	35	34	34	34	34	34	36	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	228	216	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	4	18	14	12	8	8	4	-	-	-	-	-	-	-	P. LOSS
	38	24	28	30	33	35	38	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	12.3														
	1F	2F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	25	39	22	21	21	21	24	25	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	97	60	6	-	-	-	-	-	-	PROB.
	35	41	34	34	34	34	35	36	-	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	229	215	219	221	223	225	228	231	-	-	-	-	-	-	FS.LOSS
	8	44	22	18	16	12	8	6	-	-	-	-	-	-	P. LOSS
	35	-1	19	23	27	30	34	37	-	-	-	-	-	-	S/N..DB
	99	16	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	11.5														
	1F	1E	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	25	12	23	22	21	22	25	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	98	91	32	-	-	-	-	-	-	-	PROB.
	35	32	35	34	34	34	36	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	228	215	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	10	48	24	20	16	14	8	-	-	-	-	-	-	-	P. LOSS
	33	-4	18	22	26	29	34	-	-	-	-	-	-	-	S/N..DB
	99	8	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	11.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	25	23	21	21	21	22	26	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	89	19	-	-	-	-	-	-	-	PROB.
	35	35	34	34	34	35	36	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	227	216	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	6	22	18	14	12	10	6	-	-	-	-	-	-	-	P. LOSS
	35	19	24	27	31	33	36	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	9.3														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	26	21	21	22	24	26	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	95	67	[illegible]	-	-	-	-	-	-	-	-	PROB.
	36	34	34	35	35	36	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	224	216	219	221	223	226	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	6	4	4	2	-	-	-	-	-	-	-	-	P. LOSS
	39	34	36	37	39	39	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	6.6														
	1F	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	MODE
	29	26	29	29	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	69	36	12	-	-	-	-	-	-	-	-	-	-	PROB.
	37	36	37	37	-	-	-	-	-	-	-	-	-	-	DELAY
	157	156	158	159	-	-	-	-	-	-	-	-	-	-	NOISE
	219	217	220	222	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	6	4	2	-	-	-	-	-	-	-	-	-	-	P. LOSS
	36	35	37	37	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														81	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	5.6														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	31	31	31	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	35	9	-	-	-	-	-	-	-	-	-	-	-	PROB.
	38	38	38	-	-	-	-	-	-	-	-	-	-	-	DELAY
	155	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	218	220	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	35	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
20	5.3														
	1F	1F	-	-	-	-	-	-	-	-	-	-	-	-	MODE
	33	34	-	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	23	-	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	-	-	-	-	-	-	-	-	-	-	-	-	DELAY
	154	155	-	-	-	-	-	-	-	-	-	-	-	-	NOISE
	216	218	-	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	4	-	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	32	33	-	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	-	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
22	5.6														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	34	35	35	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	33	7	-	-	-	-	-	-	-	-	-	-	-	PROB.
	40	40	40	-	-	-	-	-	-	-	-	-	-	-	DELAY
	155	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
24	5.9														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	33	33	33	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	47	12	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	39	-	-	-	-	-	-	-	-	-	-	-	DELAY
	156	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	218	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														54	=T.REL.

31 DEC SSN= 50. 36.010
TO AZIMUTHS N.MILES
359.9 1000.3
SIGMA= 1000 SQ. METERS ANT= 25DS
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 60B

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	8.5														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	15	12	13	14	16	16	-	-	-	-	-	-	-	-	ANGLE
	50	96	85	64	37	15	-	-	-	-	-	-	-	-	PROB.
	67	66	66	67	67	67	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	6	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	21	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	9.1														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	14	10	11	12	13	14	-	-	-	-	-	-	-	-	ANGLE
	50	99	96	82	54	22	-	-	-	-	-	-	-	-	PROB.
	67	65	65	66	66	67	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	235	227	230	232	234	236	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	20	23	24	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	18.2														
	1F	2F	2F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	11	22	21	10	9	8	8	9	9	11	11	-	-	-	ANGLE
	50	99	99	99	99	99	99	96	82	54	11	-	-	-	PROB.
	65	69	69	65	65	64	64	64	65	65	65	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	246	227	229	232	234	236	239	242	244	246	249	-	-	-	FS.LOSS
	4	32	24	14	12	10	8	6	4	4	2	-	-	-	P. LOSS
	30	-1	6	16	19	21	24	27	29	30	31	-	-	-	S/N..DB
	99	16	52	98	99	99	99	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
8	20.3														
	1F	2F	2F	2F	2F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	11	24	22	21	21	10	8	8	8	9	11	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	97	83	36	-	-	-	PROB.
	65	70	69	68	68	65	64	64	64	65	65	-	-	-	DELAY
	171	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	248	227	229	232	234	236	239	242	244	246	249	-	-	-	FS.LOSS
	4	56	44	34	28	18	14	10	8	6	4	-	-	-	P. LOSS
	29	-25	-11	-3	4	14	18	22	25	27	29	-	-	-	S/N..DB
	99	0	1	12	38	94	99	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	19.0														
	1F	2F	2F	2F	1E	1E	1F	1F	1F	1F	1F	-	-	-	MODE
	11	24	22	21	3	3	9	8	9	10	11	-	-	-	ANGLE
	50	99	99	99	99	99	99	99	91	68	13	-	-	-	PROB.
	65	70	69	69	63	63	64	64	64	65	65	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	247	227	229	232	234	235	239	242	244	246	249	-	-	-	FS.LOSS
	6	60	46	38	30	24	14	12	8	6	4	-	-	-	P. LOSS
	28	-29	-15	-5	2	7	17	21	25	27	29	-	-	-	S/N..DB
	99	0	0	7	25	62	98	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
12	18.3														
	1F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	11	22	21	21	10	9	8	8	9	10	11	-	-	-	ANGLE
	50	99	99	99	99	99	99	97	84	55	6	-	-	-	PROB.
	65	69	68	68	65	65	64	64	65	65	65	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	247	227	229	232	234	236	239	242	244	246	249	-	-	-	FS.LOSS
	4	42	32	26	16	14	10	8	6	4	4	-	-	-	P. LOSS
	29	-10	-0	5	16	18	22	25	27	29	31	-	-	-	S/N..DB
	99	2	19	50	97	99	99	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
14	15.0														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	12	9	8	8	8	8	9	10	12	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	94	70	23	-	-	-	-	-	PROB.
	66	64	64	64	64	64	65	65	66	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	243	227	230	232	234	236	239	242	244	-	-	-	-	-	FS.LOSS
	2	10	8	6	6	4	4	2	2	-	-	-	-	-	P. LOSS
	31	19	22	24	26	27	29	30	31	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	10.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	13	9	10	10	11	12	13	-	-	-	-	-	-	-	ANGLE
	50	99	95	88	74	55	19	-	-	-	-	-	-	-	PROB.
	66	65	65	65	65	66	66	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	237	227	230	232	234	236	239	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	2	-	-	-	-	-	-	-	P. LOSS
	27	20	23	24	26	27	29	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

		OPERATING FREQUENCIES													
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	8.8														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	14	11	12	13	15	15	-	-	-	-	-	-	-	-	ANGLE
	50	95	86	68	44	23	-	-	-	-	-	-	-	-	PROB.
	67	65	66	66	67	67	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	232	235	236	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	20	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	8.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	16	12	13	15	16	16	-	-	-	-	-	-	-	-	ANGLE
	50	96	85	62	36	17	-	-	-	-	-	-	-	-	PROB.
	68	66	66	67	68	68	-	-	-	-	-	-	-	-	DELAY
	160	155	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	20	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	8.7														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	16	13	13	15	17	17	-	-	-	-	-	-	-	-	ANGLE
	50	97	88	68	42	21	-	-	-	-	-	-	-	-	PROB.
	68	66	66	67	68	68	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	21	24	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	9.1														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	16	12	13	14	15	16	-	-	-	-	-	-	-	-	ANGLE
	50	98	91	76	52	27	-	-	-	-	-	-	-	-	PROB.
	68	66	66	66	67	68	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	235	227	230	232	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	6	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	21	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

35 DEC SSN= 50. 36.018
TO AZIMUTHS N.MILES
360.0 1800.9
ANT= 25DB
SIGMA= 1000 SQ. METERS
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB
OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	9.8														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	2	3	4	4	-	-	-	-	-	-	-	ANGLE
	50	99	95	85	67	44	6	-	-	-	-	-	-	-	PROB.
	117	115	115	115	116	116	116	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	246	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	5	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	15	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	96	46	73	86	94	96	98	-	-	-	-	-	-	-	S/N..PROB.
														93	=T.REL.
4	9.3														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	3	1	2	2	3	3	-	-	-	-	-	-	-	-	ANGLE
	50	99	97	86	60	28	-	-	-	-	-	-	-	-	PROB.
	116	115	115	115	116	116	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	245	237	240	242	244	246	-	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	-	-	-	-	-	-	-	-	P. LOSS
	13	5	9	11	13	14	-	-	-	-	-	-	-	-	S/N..DB
	88	47	69	81	86	90	-	-	-	-	-	-	-	-	S/N..PROB.
														89	=T.REL.
6	19.4														
	1F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	2	13	12	11	1	0	0	0	1	1	2	-	-	-	ANGLE
	50	99	99	99	99	99	99	98	91	70	25	-	-	-	PROB.
	115	118	117	117	115	114	114	114	114	115	115	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	257	238	240	242	244	246	249	252	254	256	259	-	-	-	FS.LOSS
	2	38	32	28	12	10	8	6	4	4	2	-	-	-	P. LOSS
	19	-19	-12	-8	8	10	13	16	18	19	20	-	-	-	S/N..DB
	98	0	1	3	64	76	88	95	97	98	99	-	-	-	S/N..PROB.
														99	=T.REL.
8	25.2														
	1F	3F	3F	2F	2F	2F	1F	2F	2F	2F	1F	1F	1F	-	MODE
	1	20	18	12	11	10	0	10	11	12	0	1	1	-	ANGLE
	50	99	99	99	99	99	99	99	90	65	92	66	23	-	PROB.
	115	123	121	118	117	117	114	117	117	118	114	114	115	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	262	238	239	242	244	246	249	252	254	257	259	261	263	-	FS.LOSS
	4	84	66	44	38	34	14	22	18	16	4	4	2	-	P. LOSS
	21	-63	-44	-22	-16	-11	8	0	4	6	19	21	22	-	S/N..DB
	99	0	0	0	0	1	69	18	39	55	99	99	99	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	25.5														
	1F	3F	3F	3F	2F	2F	1F	2F	2F	2F	1F	1F	1F	-	MODE
	1	20	18	17	11	10	1	10	11	12	0	1	1	-	ANGLE
	50	99	99	99	99	99	99	99	91	67	93	69	26	-	PROB.
	115	123	121	120	117	117	114	117	117	118	114	114	115	-	DELAY
	174	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	262	238	239	242	244	246	249	252	254	256	259	261	263	-	FS.LOSS
	4	86	70	56	40	36	14	22	20	18	6	4	4	-	P. LOSS
	22	-67	-49	-34	-18	-13	7	-0	3	5	19	21	21	-	S/N..DB
	99	0	0	0	0	1	63	21	32	49	99	99	99	-	S/N..PROB.
														99	=T.REL.
12	23.5														
	1F	3F	2F	2F	2F	1F	2F	2F	2F	2F	1F	1F	1F	-	MODE
	1	18	12	11	10	1	10	11	12	14	1	1	1	-	ANGLE
	50	99	99	99	99	99	99	95	75	38	80	41	6	-	PROB.
	115	121	118	117	117	115	117	117	118	119	114	115	115	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	261	237	240	242	244	246	249	252	254	257	259	261	263	-	FS.LOSS
	2	60	40	34	30	14	22	18	16	14	4	2	2	-	P. LOSS
	22	-39	-19	-14	-8	8	0	4	7	8	20	22	23	-	S/N..DB
	99	0	0	0	3	69	17	41	60	70	99	99	99	-	S/N..PROB.
														95	=T.REL.
14	17.9														
	1F	1F	2F	2F	2F	2F	1F	1F	1F	1F	-	-	-	-	MODE
	2	0	10	11	11	11	0	0	1	2	-	-	-	-	ANGLE
	50	99	99	99	99	97	99	96	80	48	-	-	-	-	PROB.
	115	114	117	117	117	117	114	114	115	115	-	-	-	-	DELAY
	169	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	256	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	2	14	22	20	18	16	4	4	2	2	-	-	-	-	P. LOSS
	20	5	-2	0	3	5	17	18	20	20	-	-	-	-	S/N..DB
	99	46	12	18	32	47	99	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	11.9														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	3	0	1	1	1	1	3	3	-	-	-	-	-	-	ANGLE
	50	99	99	96	90	81	49	19	-	-	-	-	-	-	PROB.
	116	114	114	114	115	115	116	116	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	249	237	240	242	244	246	249	252	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	4	-	-	-	-	-	-	P. LOSS
	16	5	9	10	13	14	16	18	-	-	-	-	-	-	S/N..DB
	98	46	73	82	91	94	98	99	-	-	-	-	-	-	S/N..PROB.
														98	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	10.3														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	1	2	2	2	3	3	-	-	-	-	-	-	-	ANGLE
	50	99	96	89	76	57	21	-	-	-	-	-	-	-	PROB.
	116	115	115	115	115	116	116	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	15	5	8	10	13	14	16	-	-	-	-	-	-	-	S/N..DB
	95	46	66	82	91	94	98	-	-	-	-	-	-	-	S/N..PROB.
														94	=T.REL.
20	10.3														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	2	3	4	4	-	-	-	-	-	-	-	ANGLE
	50	99	97	91	77	56	19	-	-	-	-	-	-	-	PROB.
	117	115	115	115	116	116	117	-	-	-	-	-	-	-	DELAY
	162	155	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	14	4	9	11	13	14	16	-	-	-	-	-	-	-	S/N..DB
	94	42	72	85	90	94	97	-	-	-	-	-	-	-	S/N..PROB.
														95	=T.REL.
22	10.4														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	3	3	4	4	-	-	-	-	-	-	-	ANGLE
	50	99	98	92	80	60	22	-	-	-	-	-	-	-	PROB.
	117	115	115	116	116	116	117	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	16	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	96	46	72	85	93	95	98	-	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.
24	10.6														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	4	2	2	2	3	3	4	-	-	-	-	-	-	-	ANGLE
	50	99	98	93	81	64	22	-	-	-	-	-	-	-	PROB.
	117	115	115	115	116	116	117	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	16	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	96	46	72	85	93	95	98	-	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.

27 DEC TO SSN= 100. 36.005
AZIMUTHS N.MILES
359.9 499.9

SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	5.7														
	1F	1F	-	-	-	-	-	-	-	-	-	-	-	-	MODE
	35	35	-	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	36	-	-	-	-	-	-	-	-	-	-	-	-	PROB.
	40	40	-	-	-	-	-	-	-	-	-	-	-	-	DELAY
	155	156	-	-	-	-	-	-	-	-	-	-	-	-	NOISE
	218	219	-	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	-	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	34	-	-	-	-	-	-	-	-	-	-	-		S/N..DB
	99	99	-	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
4	6.9														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	32	28	32	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	87	45	-	-	-	-	-	-	-	-	-	-	-	PROB.
	38	36	38	-	-	-	-	-	-	-	-	-	-	-	DELAY
	158	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	220	217	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	6	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	36	35	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														93	=T.REL.
6	14.1														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	27	23	22	22	22	22	23	27	28	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	90	53	8	-	-	-	-	-	PROB.
	36	35	34	34	34	34	35	36	36	-	-	-	-	-	DELAY
	166	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	232	216	219	221	223	225	228	232	234	-	-	-	-	-	FS.LOSS
	4	20	16	12	10	8	6	4	2	-	-	-	-	-	P. LOSS
	39	21	26	29	32	34	37	39	40	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
8	15.1														
	1F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	27	41	24	22	22	22	23	25	28	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	97	75	29	-	-	-	-	-	PROB.
	36	42	35	35	34	34	35	35	36	-	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	233	215	219	221	223	225	228	231	234	-	-	-	-	-	FS.LOSS
	6	52	24	20	18	14	10	8	6	-	-	-	-	-	P. LOSS
	37	-8	16	21	25	28	33	36	38	-	-	-	-	-	S/N..DB
	99	3	97	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	13.9														
	1F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	28	41	24	23	23	23	24	28	28	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	89	46	8	-	-	-	-	-	PROB.
	36	43	35	35	35	35	35	37	37	-	-	-	-	-	DELAY
	166	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	232	215	219	221	223	225	228	232	234	-	-	-	-	-	FS.LOSS
	8	54	26	22	18	14	10	6	6	-	-	-	-	-	P. LOSS
	36	-12	15	20	24	28	32	36	38	-	-	-	-	-	S/N..DB
	99	1	95	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
12	13.4														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	28	25	23	22	23	23	25	28	-	-	-	-	-	-	ANGLE
	50	99	99	99	99	99	84	35	-	-	-	-	-	-	PROB.
	36	35	35	35	35	35	35	37	-	-	-	-	-	-	DELAY
	166	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	231	216	219	221	223	225	229	232	-	-	-	-	-	-	FS.LOSS
	6	24	20	16	12	10	8	4	-	-	-	-	-	-	P. LOSS
	38	17	22	26	30	32	35	38	-	-	-	-	-	-	S/N..DB
	99	98	99	99	99	99	99	99	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
14	11.7														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	28	22	22	22	23	24	29	-	-	-	-	-	-	-	ANGLE
	50	99	99	99	98	91	42	-	-	-	-	-	-	-	PROB.
	37	34	34	35	35	35	37	-	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	229	216	219	221	223	225	229	-	-	-	-	-	-	-	FS.LOSS
	2	8	6	4	4	2	2	-	-	-	-	-	-	-	P. LOSS
	40	33	36	37	38	39	40	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
16	8.1														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	30	25	26	29	30	30	-	-	-	-	-	-	-	-	ANGLE
	50	94	80	53	31	14	-	-	-	-	-	-	-	-	PROB.
	37	35	36	37	38	38	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	223	216	219	222	225	226	-	-	-	-	-	-	-	-	FS.LOSS
	2	6	4	2	2	2	-	-	-	-	-	-	-	-	P. LOSS
	38	35	37	37	38	39	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	5.9														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	33	33	33	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	46	19	-	-	-	-	-	-	-	-	-	-	-	PROB.
	39	39	39	-	-	-	-	-	-	-	-	-	-	-	DELAY
	156	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	218	218	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														57	=T.REL.
20	5.2														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	35	35	35	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	25	6	-	-	-	-	-	-	-	-	-	-	-	PROB.
	40	40	40	-	-	-	-	-	-	-	-	-	-	-	DELAY
	154	155	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	216	219	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	6	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	32	33	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
22	5.5														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	36	36	36	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	34	10	-	-	-	-	-	-	-	-	-	-	-	PROB.
	40	40	40	-	-	-	-	-	-	-	-	-	-	-	DELAY
	155	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	217	219	222	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	33	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.
24	5.8														
	1F	1F	1F	-	-	-	-	-	-	-	-	-	-	-	MODE
	35	35	35	-	-	-	-	-	-	-	-	-	-	-	ANGLE
	50	42	7	-	-	-	-	-	-	-	-	-	-	-	PROB.
	40	40	40	-	-	-	-	-	-	-	-	-	-	-	DELAY
	156	156	158	-	-	-	-	-	-	-	-	-	-	-	NOISE
	218	219	221	-	-	-	-	-	-	-	-	-	-	-	FS.LOSS
	4	4	4	-	-	-	-	-	-	-	-	-	-	-	P. LOSS
	34	34	36	-	-	-	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	-	-	-	-	-	-	-	-	-	-	-	S/N..PROB.
														50	=T.REL.

31 DEC SSN= 100. 36.010
TO AZIMUTHS N.MILES
359.9 1000.3
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	8.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	17	13	14	15	17	17	-	-	-	-	-	-	-	-	ANGLE
	50	98	89	64	32	10	-	-	-	-	-	-	-	-	PROB.
	68	66	67	67	68	68	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	21	24	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
4	9.5														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	15	11	11	12	13	15	-	-	-	-	-	-	-	-	ANGLE
	50	99	98	89	66	33	-	-	-	-	-	-	-	-	PROB.
	67	65	66	66	66	67	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	236	227	230	232	234	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	10	8	6	4	4	-	-	-	-	-	-	-	-	P. LOSS
	28	20	23	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
6	21.4														
	1F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	MODE
	12	23	22	22	10	9	9	9	9	10	12	12	-	-	ANGLE
	50	99	99	99	99	99	99	99	97	89	56	13	-	-	PROB.
	66	69	69	69	65	65	65	65	65	65	66	66	-	-	DELAY
	171	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	249	227	229	232	234	236	239	242	244	246	249	251	-	-	FS.LOSS
	2	38	28	22	14	12	8	6	6	4	2	2	-	-	P. LOSS
	31	-6	2	8	17	19	23	26	28	29	31	32	-	-	S/N..DB
	99	5	25	70	98	99	99	99	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.
8	24.7														
	1F	2F	2F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	-	MODE
	12	25	23	22	22	22	9	9	9	9	10	11	12	-	ANGLE
	50	99	99	99	99	99	99	99	99	97	84	57	21	-	PROB.
	66	71	70	69	69	69	65	65	65	65	65	65	66	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	252	227	229	232	234	235	239	242	244	246	249	251	253	-	FS.LOSS
	4	66	50	40	32	28	16	12	10	8	6	4	2	-	P. LOSS
	31	-34	-18	-8	-0	5	17	21	24	26	29	31	31	-	S/N..DB
	99	0	0	3	19	47	98	99	99	99	99	99	99	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	22.8														
	1F	3F	2F	2F	2F	1E	1F	1F	1F	1F	1F	1F	1F	-	MODE
	12	33	24	23	22	3	10	9	9	9	11	12	12	-	ANGLE
	50	99	99	99	99	99	99	99	98	92	70	32	6	-	PROB.
	66	76	70	69	69	63	65	65	65	65	65	66	66	-	DELAY
	172	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	250	226	229	232	234	235	239	242	244	246	249	251	253	-	FS.LOSS
	4	70	54	44	34	28	16	12	10	8	6	4	4	-	P. LOSS
	30	-39	-22	-11	-2	3	16	20	24	26	28	30	31	-	S/N..DB
	99	0	0	1	13	33	98	99	99	99	99	99	99	-	S/N..PROB.
														99	=T.REL.
12	22.1														
	1F	2F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	-	-	MODE
	12	24	23	22	23	10	9	9	9	10	11	12	-	-	ANGLE
	50	99	99	99	99	99	99	99	99	93	65	24	-	-	PROB.
	66	70	69	69	69	65	65	65	65	65	65	66	-	-	DELAY
	172	156	158	159	161	162	164	166	168	169	171	173	-	-	NOISE
	250	227	229	232	234	236	239	242	244	246	249	251	-	-	FS.LOSS
	4	48	38	30	24	16	12	8	6	6	4	2	-	-	P. LOSS
	31	-17	-5	1	8	16	20	24	27	28	30	32	-	-	S/N..DB
	99	0	6	23	67	97	99	99	99	99	99	99	-	-	S/N..PROB.
														99	=T.REL.
14	18.9														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	MODE
	13	9	9	9	9	9	9	9	10	12	13	-	-	-	ANGLE
	50	99	99	99	99	99	99	98	89	65	18	-	-	-	PROB.
	66	65	65	65	64	65	65	65	65	66	66	-	-	-	DELAY
	170	156	158	159	161	162	164	166	168	169	171	-	-	-	NOISE
	247	227	230	232	234	236	239	242	244	246	249	-	-	-	FS.LOSS
	2	10	8	6	6	4	4	2	2	2	0	-	-	-	P. LOSS
	32	20	22	24	26	27	29	30	31	32	33	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	99	99	99	-	-	-	S/N..PROB.
														99	=T.REL.
16	12.4														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	MODE
	14	10	10	10	10	11	13	14	14	-	-	-	-	-	ANGLE
	50	99	99	98	95	87	58	29	10	-	-	-	-	-	PROB.
	67	65	65	65	65	65	66	67	67	-	-	-	-	-	DELAY
	165	156	158	159	161	162	164	166	168	-	-	-	-	-	NOISE
	240	227	230	232	234	236	239	242	245	-	-	-	-	-	FS.LOSS
	2	10	8	6	4	4	2	2	2	-	-	-	-	-	P. LOSS
	30	20	23	24	26	27	29	30	31	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	99	99	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	8.9														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	15	12	12	13	15	15	15	-	-	-	-	-	-	-	ANGLE
	50	97	90	73	49	30	6	-	-	-	-	-	-	-	PROB.
	67	66	6[illegible]	66	67	67	67	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	235	227	230	232	235	237	240	-	-	-	-	-	-	-	FS.LOSS
	4	10	6	6	4	4	2	-	-	-	-	-	-	-	P. LOSS
	27	20	23	25	27	27	29	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	99	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
20	8.2														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	17	13	14	16	17	17	-	-	-	-	-	-	-	-	ANGLE
	50	98	88	57	33	17	-	-	-	-	-	-	-	-	PROB.
	68	66	67	68	68	68	-	-	-	-	-	-	-	-	DELAY
	160	155	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	233	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	26	20	24	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
22	8.4														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	18	14	15	16	18	18	-	-	-	-	-	-	-	-	ANGLE
	50	99	91	66	39	21	-	-	-	-	-	-	-	-	PROB.
	69	67	67	68	69	69	-	-	-	-	-	-	-	-	DELAY
	160	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	234	228	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	2	-	-	-	-	-	-	-	-	P. LOSS
	26	21	24	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.
24	8.9														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	17	13	14	15	17	17	-	-	-	-	-	-	-	-	ANGLE
	50	99	93	75	45	19	-	-	-	-	-	-	-	-	PROB.
	68	66	67	67	68	68	-	-	-	-	-	-	-	-	DELAY
	161	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	235	227	230	233	235	237	-	-	-	-	-	-	-	-	FS.LOSS
	4	8	6	4	4	4	-	-	-	-	-	-	-	-	P. LOSS
	27	21	24	25	27	27	-	-	-	-	-	-	-	-	S/N..DB
	99	99	99	99	99	99	-	-	-	-	-	-	-	-	S/N..PROB.
														99	=T.REL.

35 DEC SSN= 100. 36.018
TO AZ.MUTHS N.MILES
360.0 1800.9
SIGMA= 1000 SQ. METERS ANT= 25DB
OFF AZIMUTH 0 DEG. MIN. ANGLE= -0 DEG. OFF AZIMUTH 0 DEG.
PWR=200.00KW 3 MC/S MAN. NOISE = -148 DBW REQ.S/N= 6DB

OPERATING FREQUENCIES

GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
2	10.2														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	5	2	2	3	3	4	5	-	-	-	-	-	-	-	ANGLE
	50	99	99	94	80	55	12	-	-	-	-	-	-	-	PROB.
	117	115	115	116	116	117	117	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	246	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	15	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	96	46	73	86	94	96	98	-	-	-	-	-	-	-	S/N..PROB.
														96	=T.REL.
4	10.1														
	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	-	MODE
	4	2	2	2	3	4	-	-	-	-	-	-	-	-	ANGLE
	50	99	99	94	80	54	-	-	-	-	-	-	-	-	PROB.
	116	115	115	115	116	116	-	-	-	-	-	-	-	-	DELAY
	162	156	158	159	161	162	-	-	-	-	-	-	-	-	NOISE
	246	237	240	242	244	246	-	-	-	-	-	-	-	-	FS.LOSS
	6	14	10	8	6	6	-	-	-	-	-	-	-	-	P. LOSS
	15	5	9	11	13	14	-	-	-	-	-	-	-	-	S/N..DB
	93	47	69	81	86	90	-	-	-	-	-	-	-	-	S/N..PROB.
														94	=T.REL.
6	23.0														
	1F	2F	2F	2F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	MODE
	2	14	12	12	2	1	0	0	1	1	2	2	2	-	ANGLE
	50	99	99	99	99	99	99	99	99	95	74	34	5	-	PROB.
	115	119	118	118	115	115	114	114	114	114	115	115	115	-	DELAY
	172	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	260	238	240	242	244	246	249	252	254	256	259	261	263	-	FS.LOSS
	2	42	36	30	14	12	8	6	4	4	2	2	2	-	P. LOSS
	20	-23	-16	-11	6	9	12	15	17	18	20	21	22	-	S/N..DB
	99	0	0	1	52	71	85	93	96	97	99	99	99	-	S/N..PROB.
														99	=T.REL.
8	31.0														
	-	3F	3F	3F	2F	2F	1F	1F	2F	2F	1F	1F	1F	1F	MODE
	-	21	19	18	12	11	1	0	11	11	0	0	1	2	ANGLE
	-	99	99	99	99	99	99	99	98	92	99	94	81	59	PROB.
	-	124	122	121	118	117	115	114	117	117	114	114	114	115	DELAY
	-	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	-	238	239	242	244	246	249	252	254	256	259	261	263	265	FS.LOSS
	-	90	76	58	42	36	16	12	20	18	6	4	4	2	P. LOSS
	-	-70	-55	-37	-20	-15	6	11	2	5	18	20	21	23	S/N..DB
	-	0	0	0	0	0	56	84	27	49	98	99	99	99	S/N..PROB.
														99	=T.REL.

OPERATING FREQUENCIES

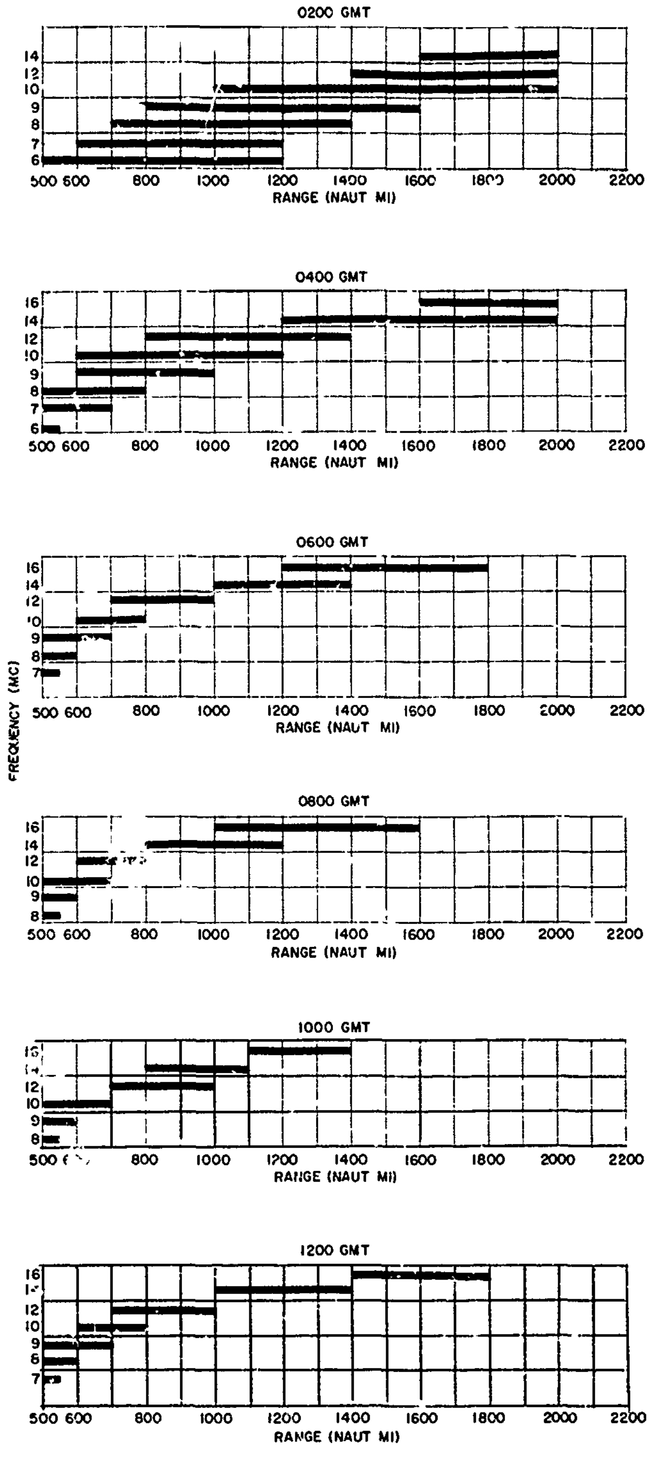
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
10	31.5														
	-	3F	3F	3F	2F	2F	2F	1F	2F	2F	1F	1F	1F	1F	MODE
	-	21	20	19	12	11	11	0	11	11	0	0	1	1	ANGLE
	-	99	99	99	99	99	99	99	98	93	99	95	83	63	PROB.
	-	124	122	122	118	117	117	114	117	117	114	114	114	115	DELAY
	-	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	-	238	239	242	244	246	249	252	254	256	259	261	263	265	FS.LOSS
	-	94	82	62	44	38	30	12	22	18	6	4	4	4	P. LOSS
	-	-75	-60	-42	-22	-17	-8	10	2	4	18	20	21	23	S/N..DB
	-	0	0	0	0	0	3	81	25	41	99	99	99	99	S/N..PROB.
														99	=T.REL.
12	29.7														
	1F	3F	2F	2F	2F	2F	1F	2F	2F	1F	1F	1F	1F	1F	MODE
	2	20	13	12	11	11	0	11	11	0	0	1	1	2	ANGLE
	50	99	99	99	99	99	99	99	98	99	99	94	77	47	PROB.
	115	122	119	118	117	117	114	117	117	114	114	114	115	115	DELAY
	175	156	158	159	161	162	164	166	168	169	171	173	174	175	NOISE
	265	237	240	242	244	246	249	252	254	256	259	261	263	265	FS.LOSS
	2	72	44	38	34	28	12	20	18	6	4	4	2	2	P. LOSS
	23	-51	-23	-17	-11	-7	11	3	6	18	20	22	22	24	S/N..DB
	99	0	0	0	1	4	86	34	53	99	99	99	99	99	S/N..PROB.
														99	=T.REL.
14	23.5														
	1F	1F	1F	1F	2F	2F	1F	1F	1F	1F	1F	1F	1F	-	MODE
	2	1	0	0	11	11	0	0	0	1	1	2	2	-	ANGLE
	50	99	99	99	99	99	99	99	99	97	81	44	12	-	PROB.
	115	114	114	114	117	117	114	114	114	114	115	115	115	-	DELAY
	173	156	158	159	161	162	164	166	168	169	171	173	174	-	NOISE
	261	237	240	242	244	246	249	252	254	256	259	261	263	-	FS.LOSS
	2	14	10	8	18	16	4	4	2	2	2	2	0	-	P. LOSS
	23	5	9	11	3	5	17	18	20	20	21	23	23	-	S/N..DB
	99	46	73	86	32	47	99	99	99	99	99	99	99	-	S/N..PROB.
														99	=T.REL.
16	15.2														
	1F	1F	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	MODE
	3	1	1	1	1	1	1	2	3	3	-	-	-	-	ANGLE
	50	99	99	99	99	98	89	67	41	21	-	-	-	-	PROB.
	116	114	114	114	114	115	115	115	116	116	-	-	-	-	DELAY
	167	156	158	159	161	162	164	166	168	169	-	-	-	-	NOISE
	253	237	240	242	244	246	249	252	254	256	-	-	-	-	FS.LOSS
	2	14	10	8	6	6	4	4	2	2	-	-	-	-	P. LOSS
	19	5	8	10	13	14	16	18	19	20	-	-	-	-	S/N..DB
	99	46	66	82	91	94	98	99	99	99	-	-	-	-	S/N..PROB.
														99	=T.REL.

		OPERATING FREQUENCIES													
GMT	MUF	6	7	8	9	10	12	14	16	18	21	24	27	30	
18	11.4														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	4	2	2	2	2	3	4	4	-	-	-	-	-	-	ANGLE
	50	99	99	96	89	76	40	15	-	-	-	-	-	-	PROB.
	117	115	115	115	115	116	116	116	-	-	-	-	-	-	DELAY
	164	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	248	237	240	242	244	246	249	252	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	2	-	-	-	-	-	-	P. LOSS
	16	5	8	10	13	14	16	18	-	-	-	-	-	-	S/N..DB
	97	46	66	82	91	94	98	99	-	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
20	10.7														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	5	3	3	3	3	4	5	5	-	-	-	-	-	-	ANGLE
	50	99	99	98	90	70	30	9	-	-	-	-	-	-	PROB.
	117	116	116	116	116	117	117	117	-	-	-	-	-	-	DELAY
	163	155	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	252	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	2	-	-	-	-	-	-	P. LOSS
	15	4	9	11	13	14	16	18	-	-	-	-	-	-	S/N..DB
	95	42	72	85	90	94	97	99	-	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
22	10.6														
	1F	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	MODE
	5	3	3	3	4	4	5	5	-	-	-	-	-	-	ANGLE
	50	99	99	98	89	69	29	9	-	-	-	-	-	-	PROB.
	117	116	116	116	116	117	117	117	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	166	-	-	-	-	-	-	NOISE
	247	237	240	242	244	246	249	252	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	2	-	-	-	-	-	-	P. LOSS
	16	5	9	11	14	15	17	18	-	-	-	-	-	-	S/N..DB
	96	46	72	85	93	95	98	99	-	-	-	-	-	-	S/N..PROB.
														97	=T.REL.
24	10.8														
	1F	1F	1F	1F	1F	1F	1F	-	-	-	-	-	-	-	MODE
	5	2	3	3	3	4	5	-	-	-	-	-	-	-	ANGLE
	50	99	99	97	88	70	23	-	-	-	-	-	-	-	PROB.
	117	115	116	116	116	116	117	-	-	-	-	-	-	-	DELAY
	163	156	158	159	161	162	164	-	-	-	-	-	-	-	NOISE
	248	237	240	242	244	246	249	-	-	-	-	-	-	-	FS.LOSS
	4	14	10	8	6	6	4	-	-	-	-	-	-	-	P. LOSS
	16	5	9	11	14	15	17	-	-	-	-	-	-	-	S/N..DB
	97	46	72	85	93	95	98	-	-	-	-	-	-	-	S/N..PROB.
														98	=T.REL.

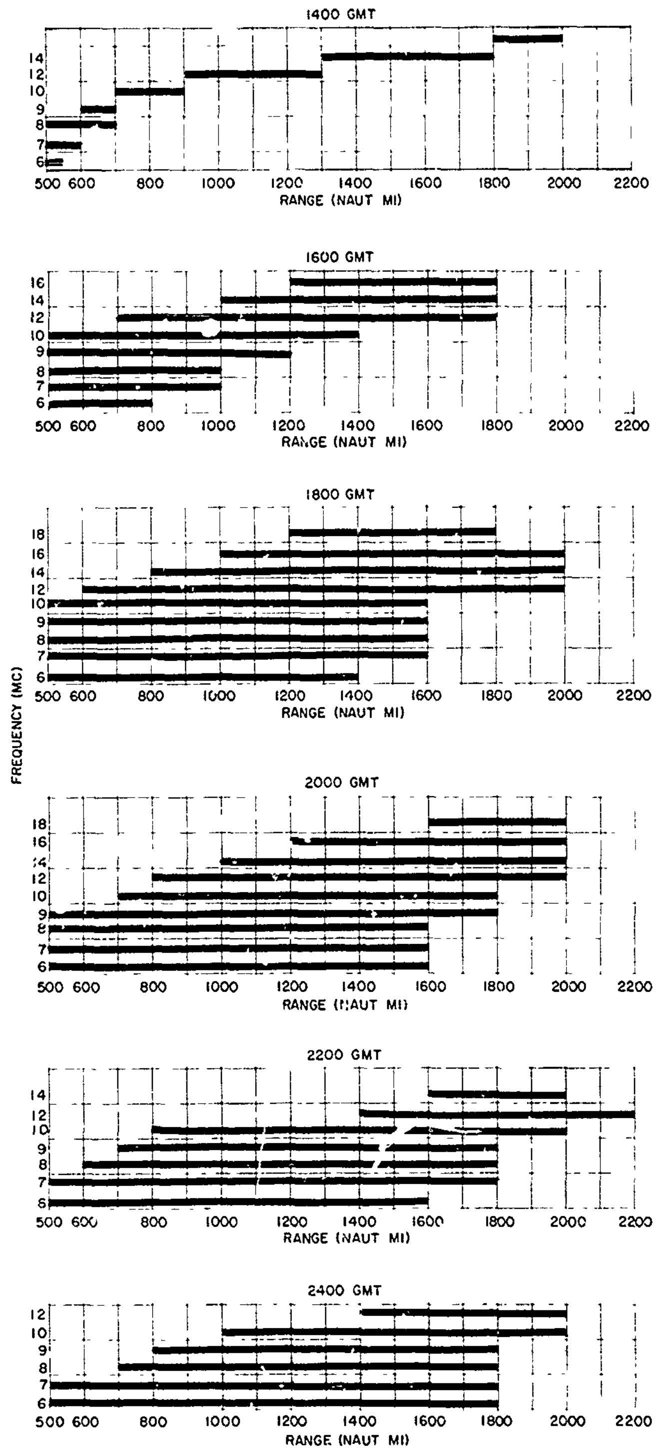
APPENDIX B

FREQUENCY REQUIREMENTS

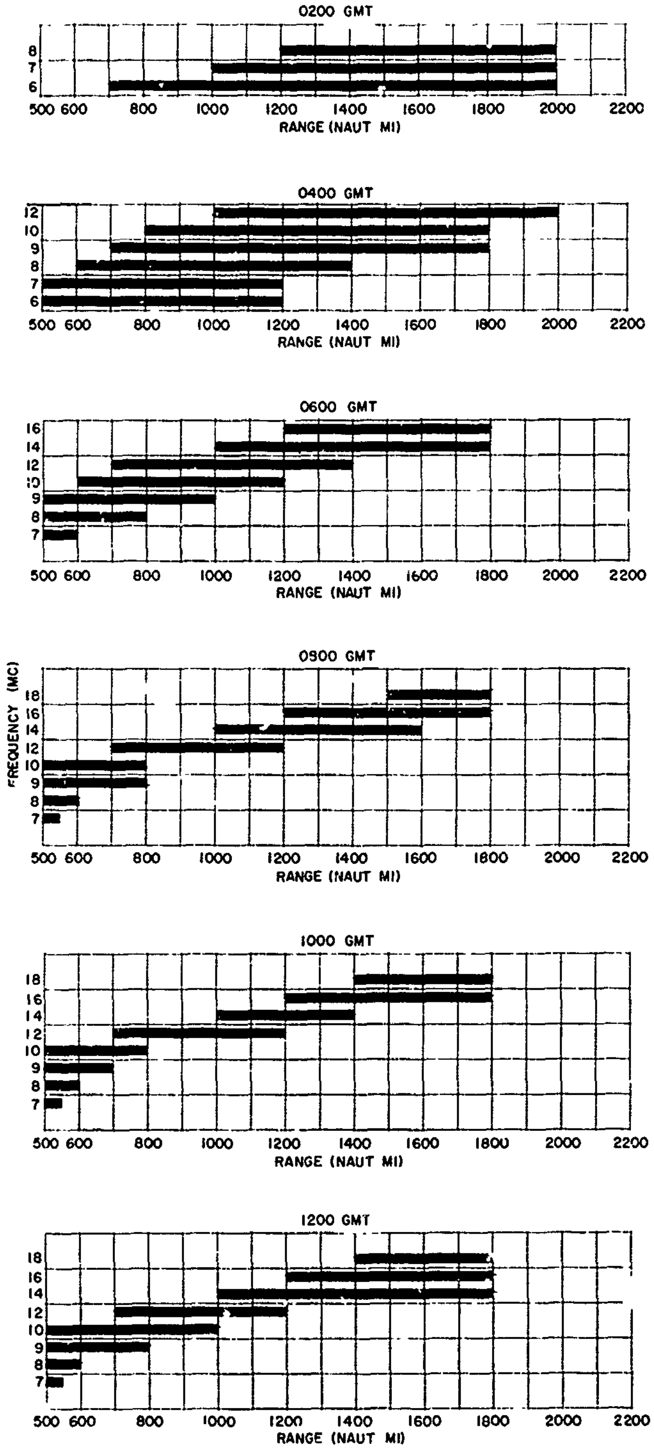
This appendix provides a simplified exhibit intended to show useful and required frequency spans. The median MUF that provides at least a 10-db postintegration signal-to-noise ratio is used to set the upper frequency bound. The lower limit is selected as the lowest frequency that provides a 10-db postintegration signal-to-noise ratio, unless the minimum range of 500 naut mi or minimum frequency of 6 Mc sets the lower bound first.


0200 GMT
0400 GMT
0600 GMT
0800 GMT
1000 GMT
1200 GMT
FREQUENCY (MC)
RANGE (NAUT MI)

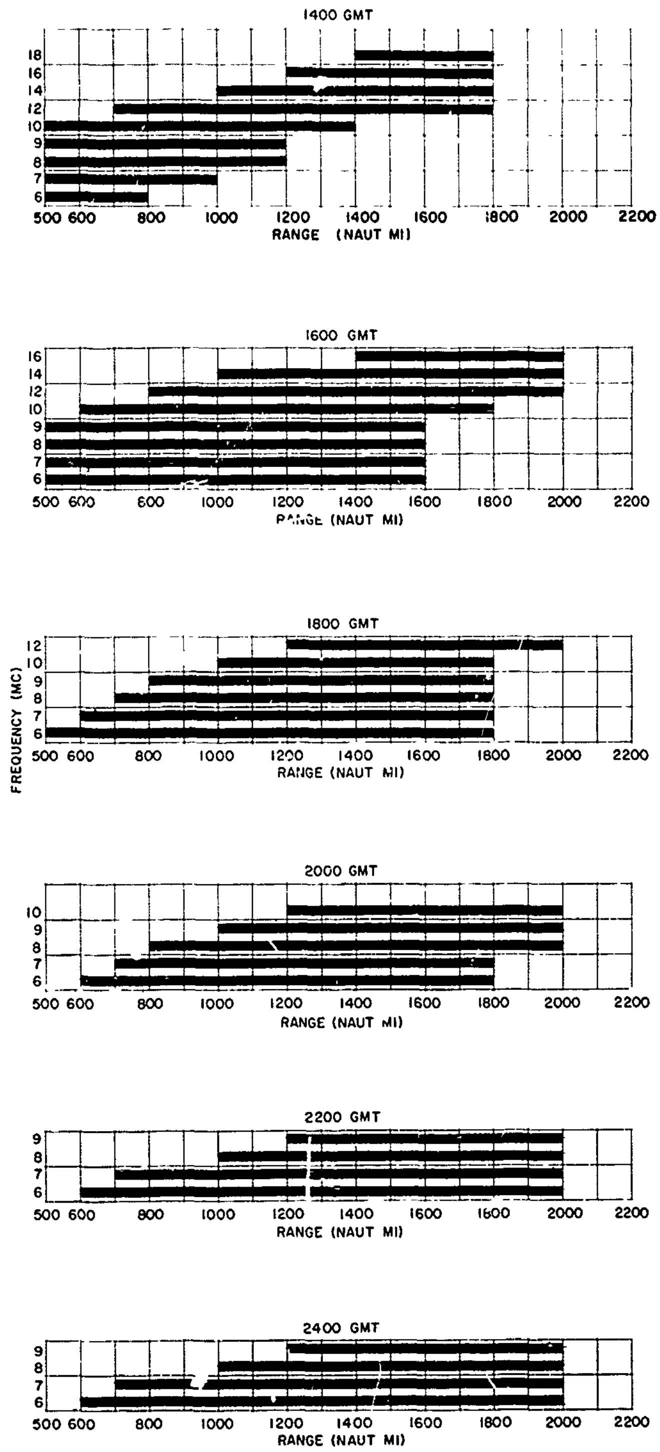
SSN-10 June


1400 GMT
1600 GMT
1800 GMT
2000 GMT
2200 GMT
2400 GMT
FREQUENCY (MC)
RANGE (NAUT MI)
500 600 800 1000 1200 1400 1600 1800 2000 2200

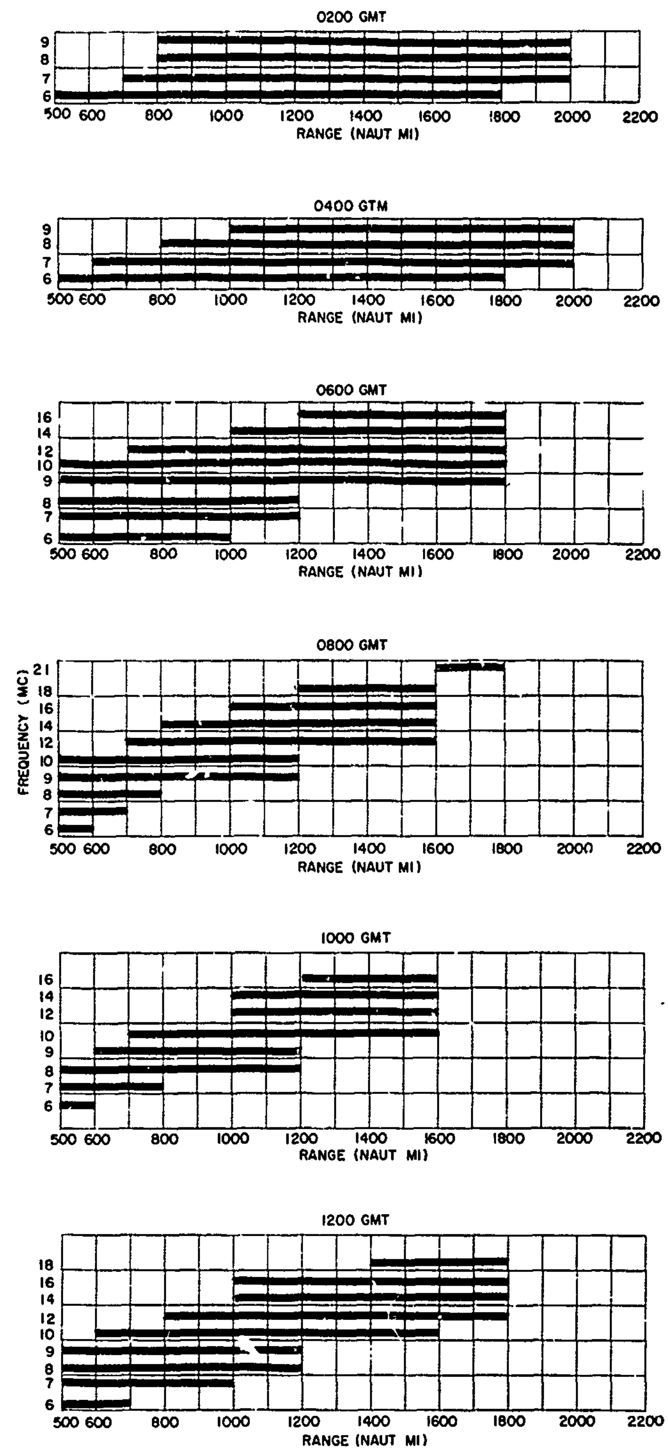
SSN-10 June



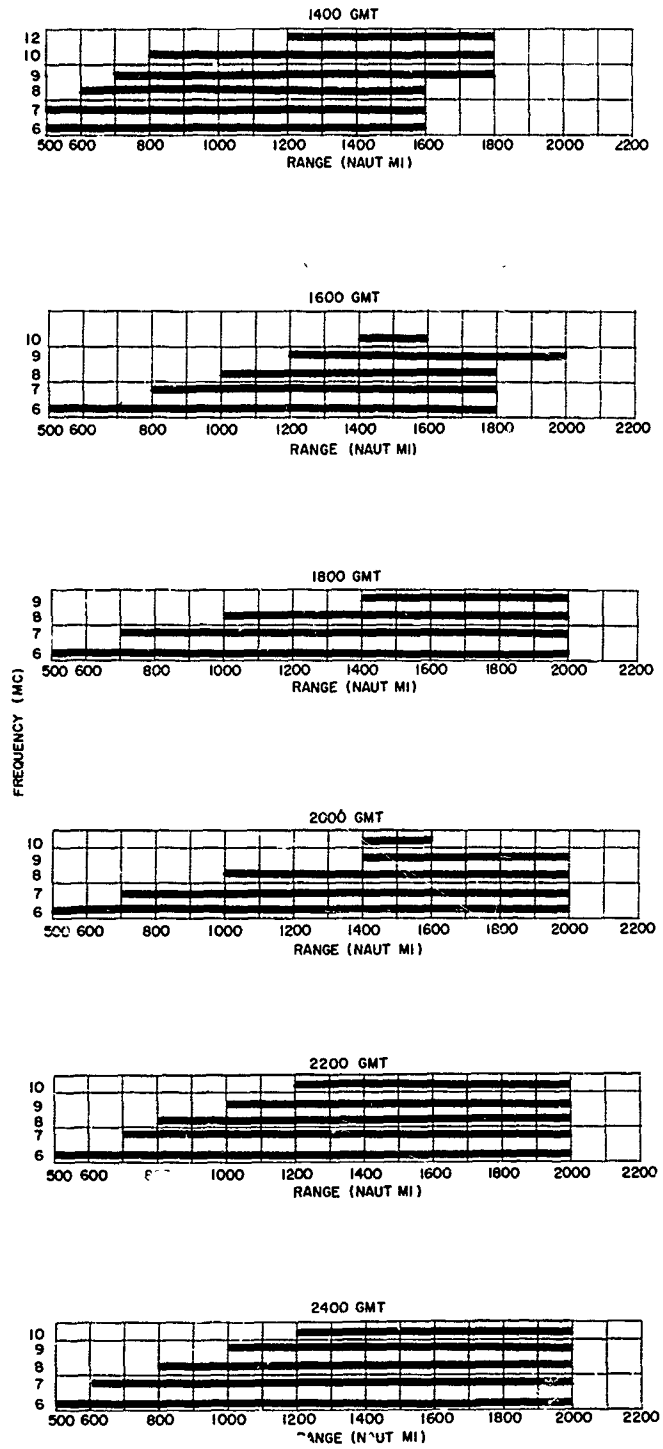
SSN-10 March - September



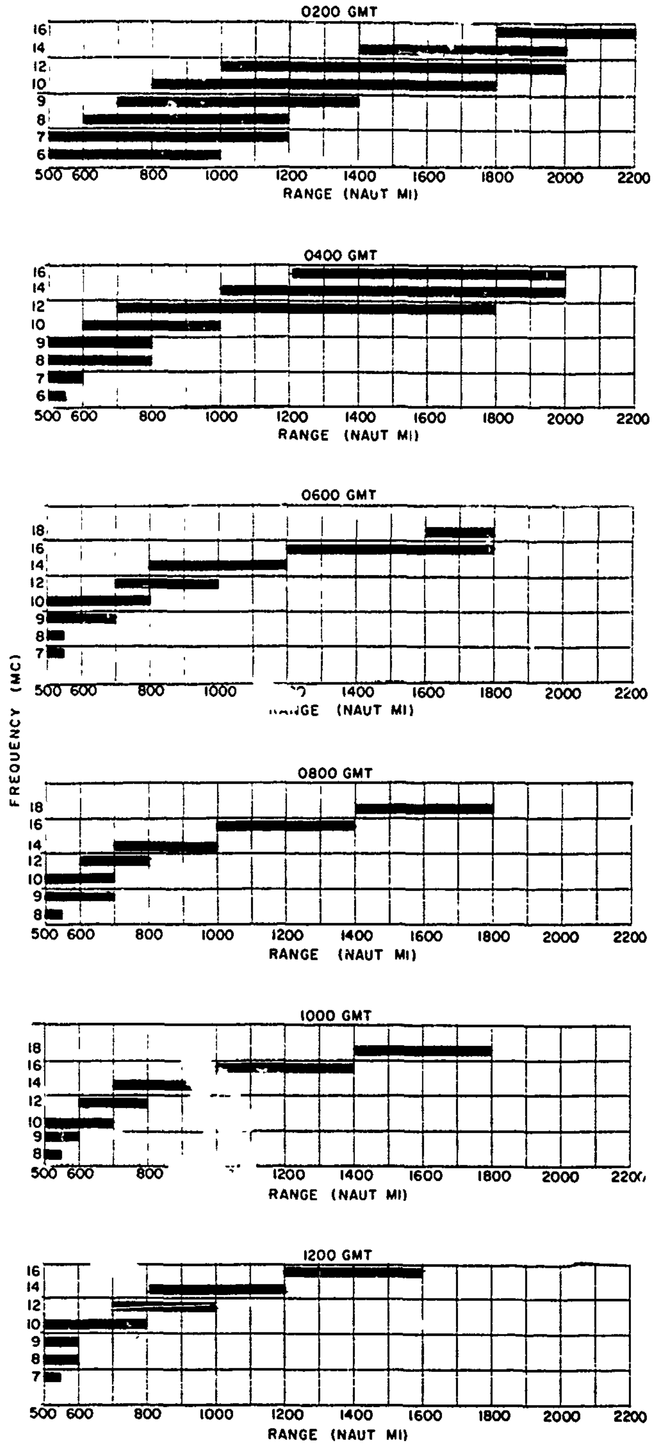
SSN-10 March - September



SSN-10 December



SSN-10 December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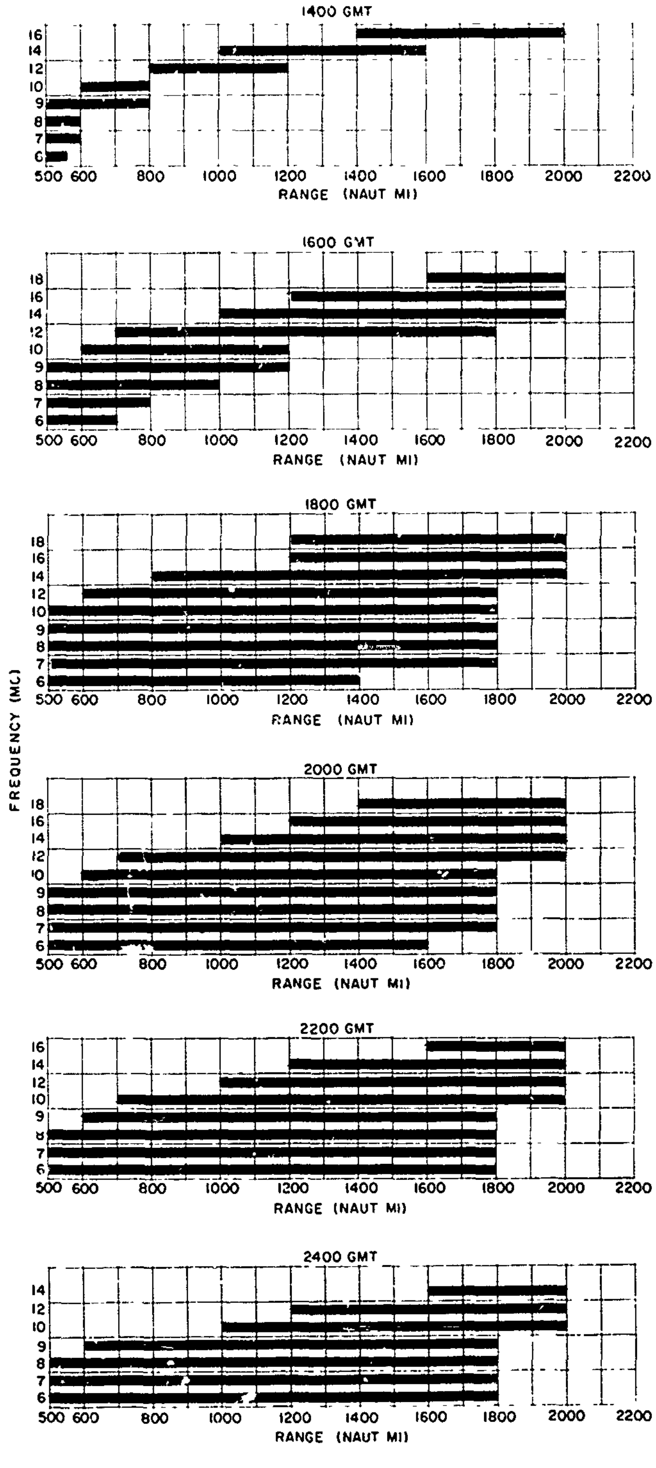
0800 GMT
1000 GMT
1200 GMT
FREQUENCY (MC)
RANGE (NAUT MI)
500 600 800 1000 1200 1400 1600 1800 2000 2200

SSN-50 June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1800 GMT
2000 GMT
2200 GMT
2400 GMT
FREQUENCY (MC)
RANGE (NAUT MI)
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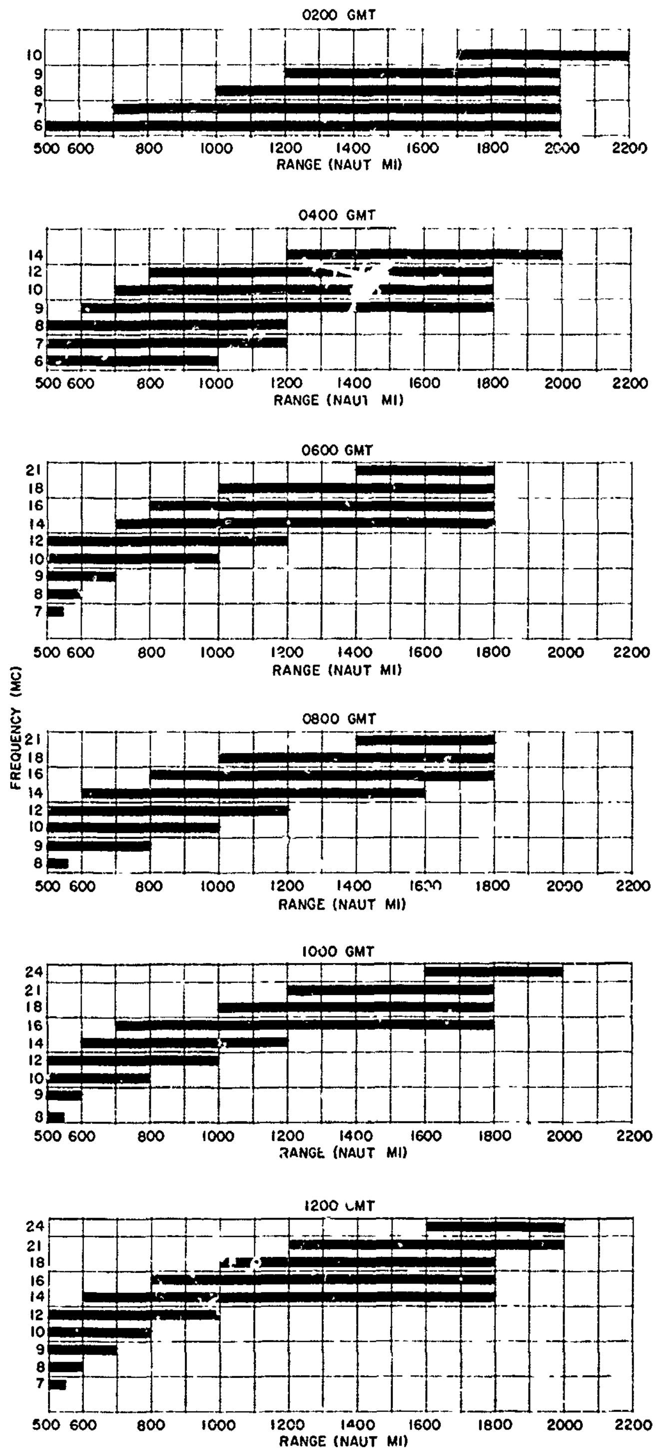
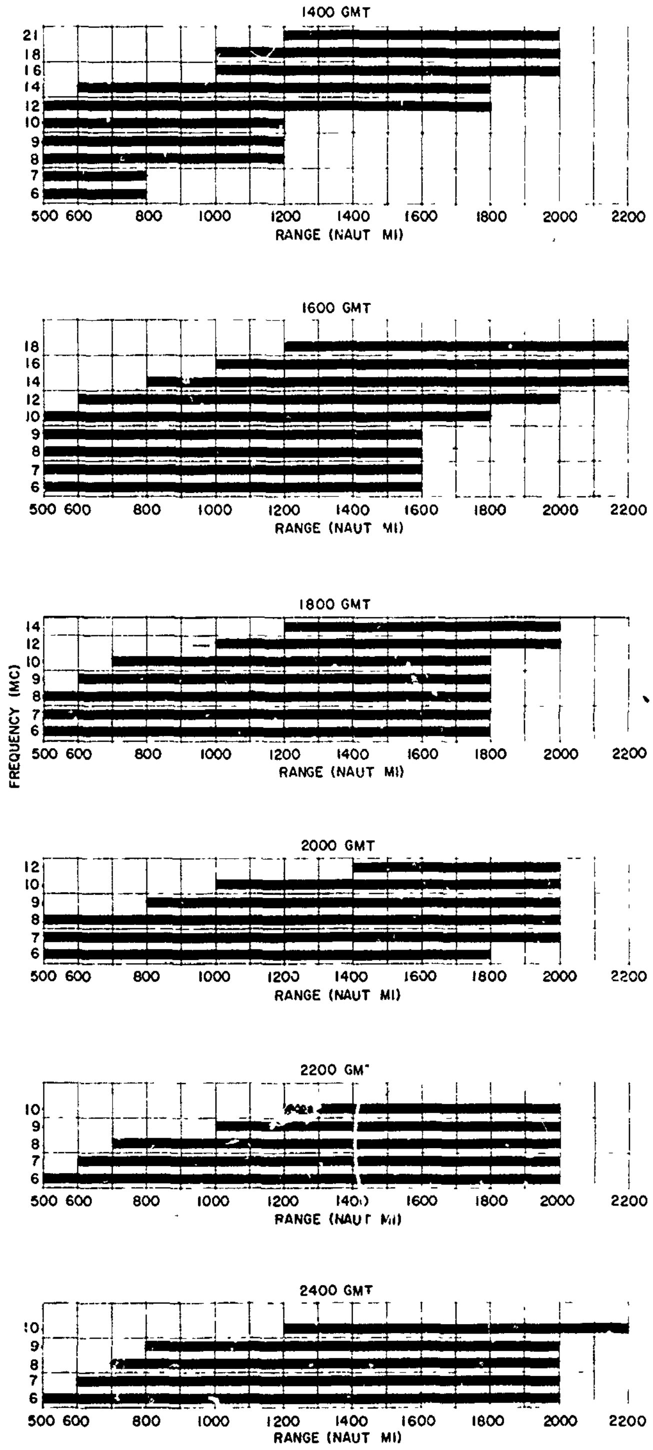
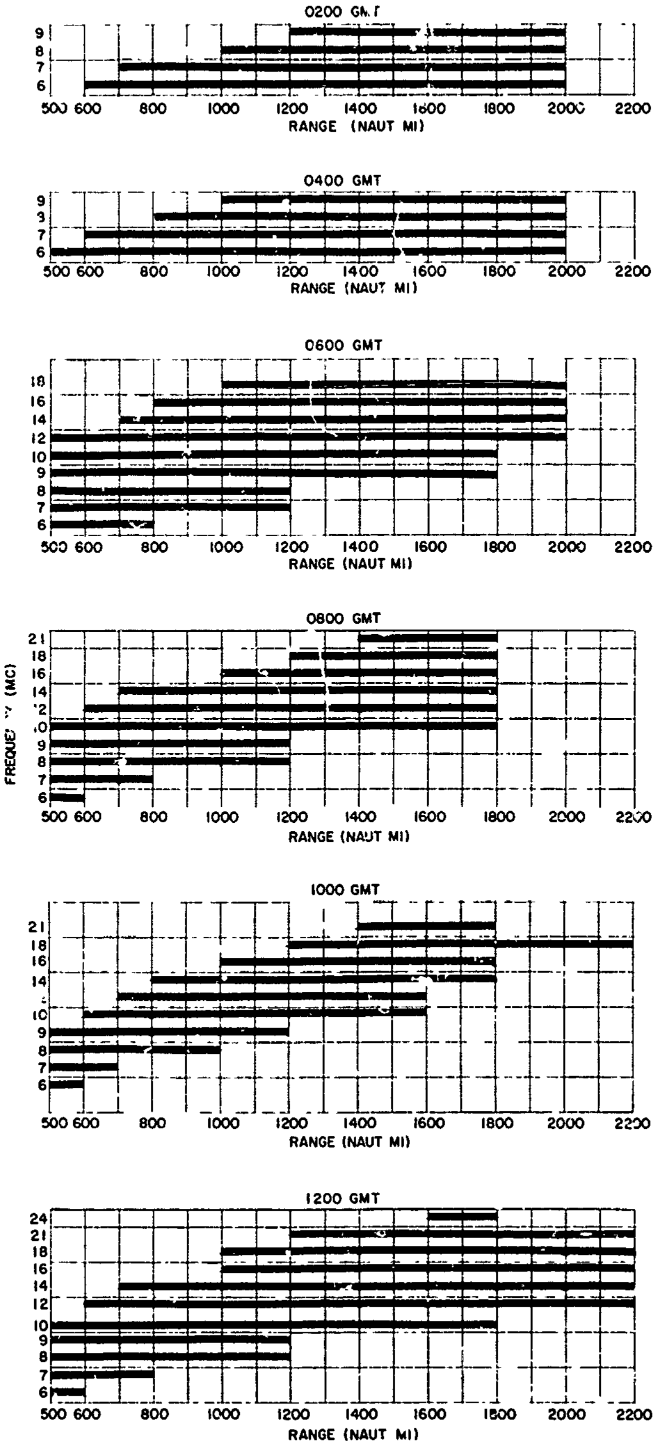
SSN-50 June



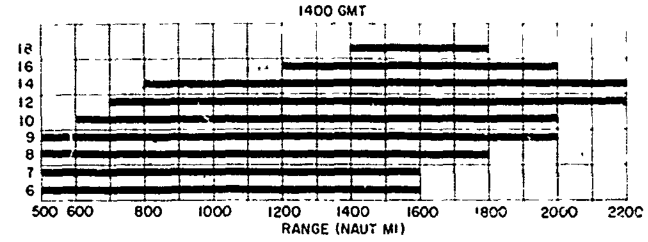
SSN-50 March - September

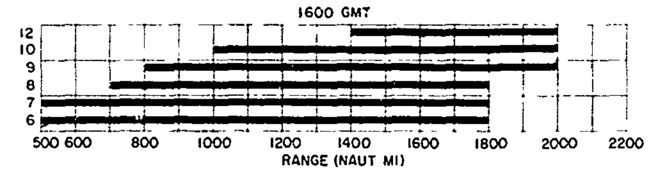


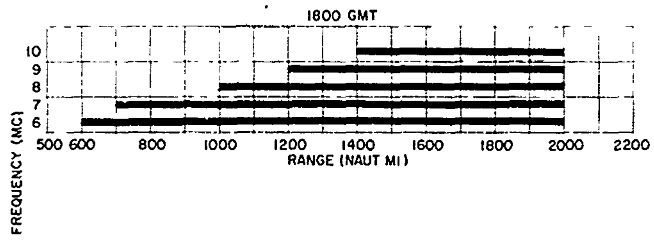
SSN-50 March - September

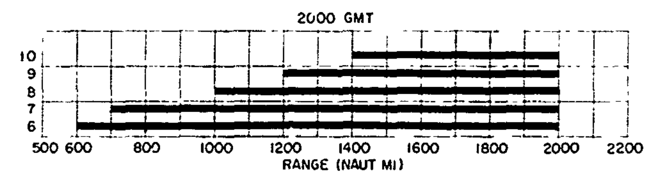


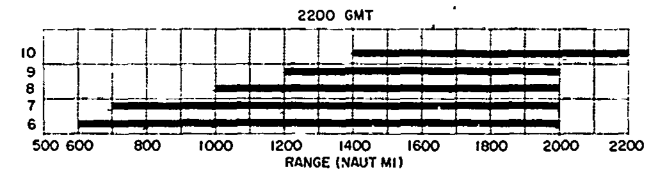
SSN-50 December

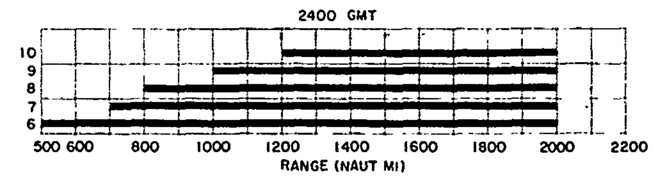




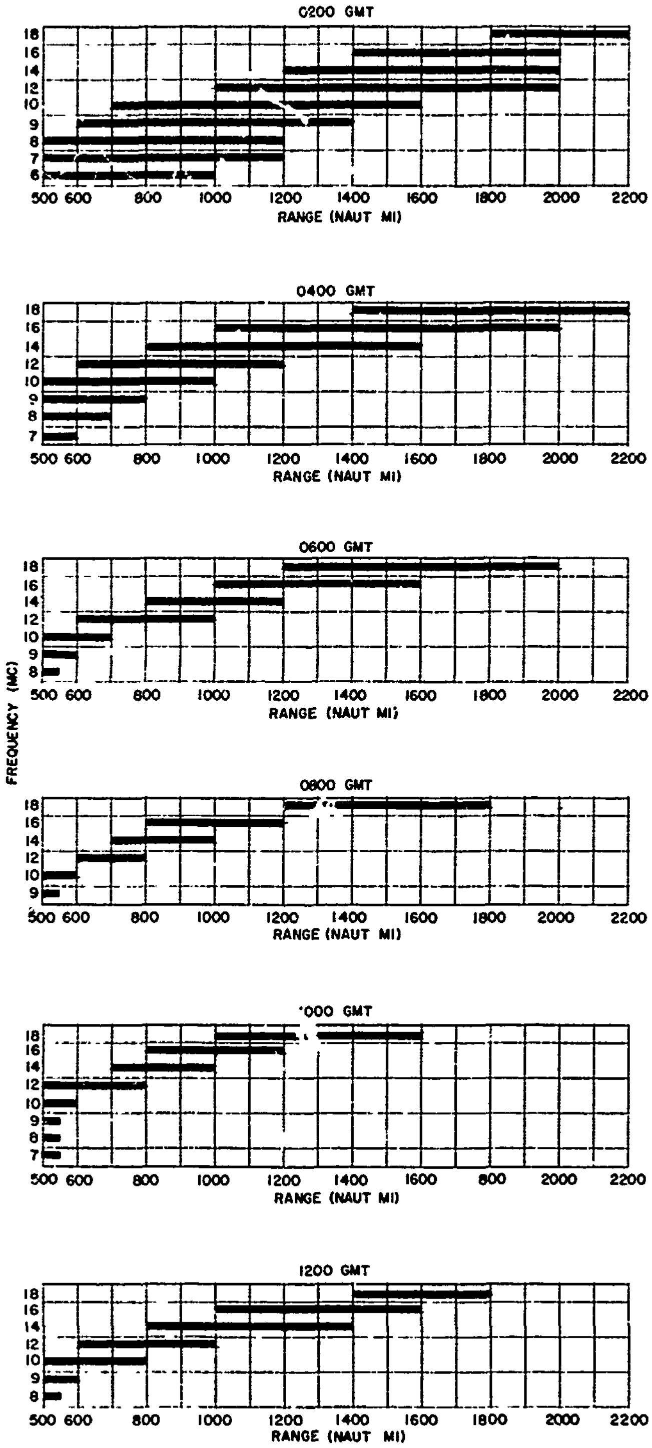




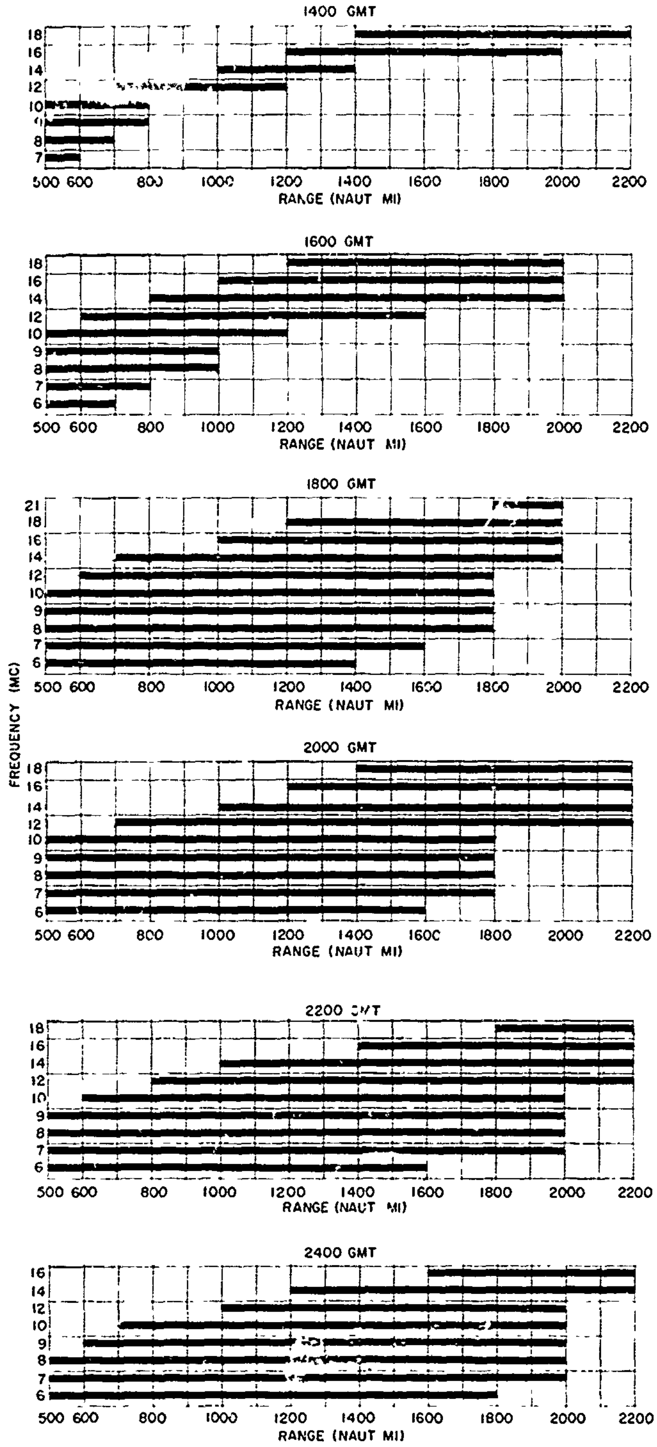




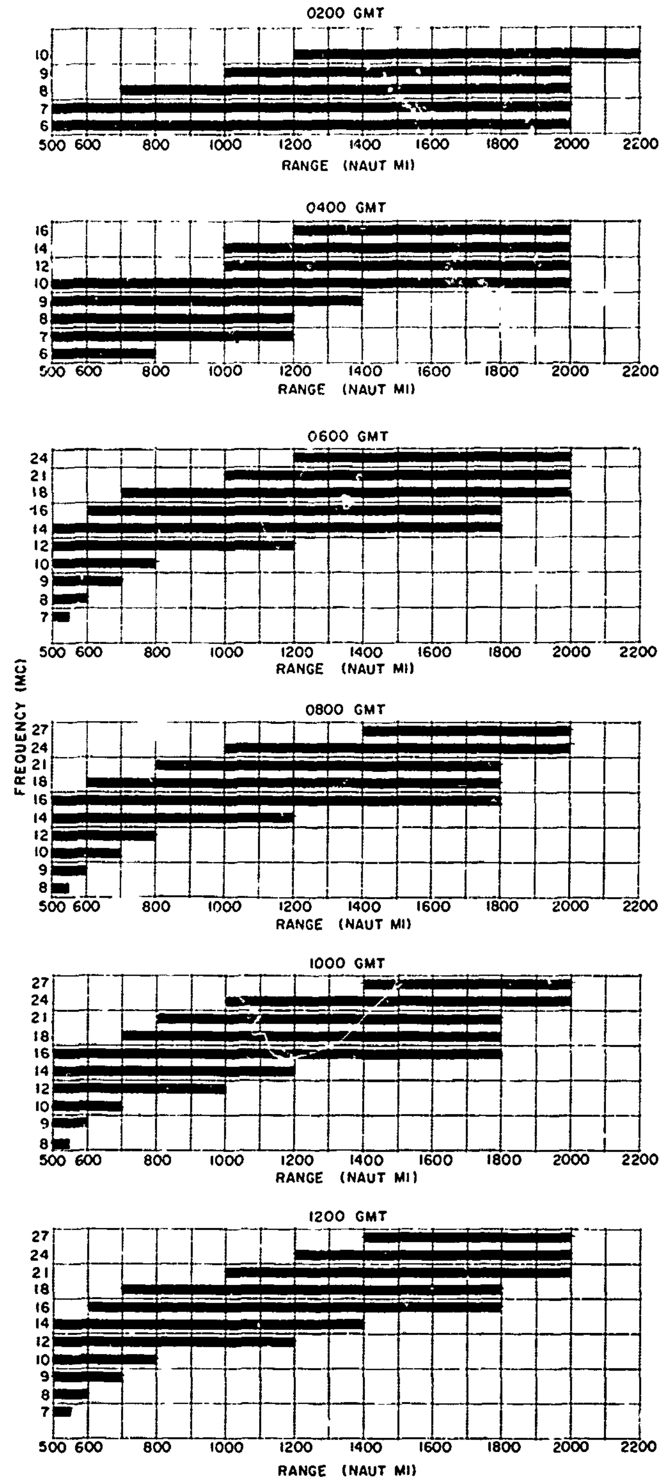
SSN-50 December


0200 GMT
18 16 14 12 10 9 8 7 6
500 600 800 1000 1200 1400 1600 1800 2000 2200
RANGE (NAUT MI)
0400 GMT
18 16 14 12 10 9 8 7
500 600 800 1000 1200 1400 1600 1800 2000 2200
RANGE (NAUT MI)
0600 GMT
18 16 14 12 10 9 8
500 600 800 1000 1200 1400 1600 1800 2000 2200
RANGE (NAUT MI)
FREQUENCY (MC)
0800 GMT
18 16 14 12 10 9
500 600 800 1000 1200 1400 1600 1800 2000 2200
RANGE (NAUT MI)
'000 GMT
18 16 14 12 10 9 8 7
500 600 800 1000 1200 1400 1600 800 2000 2200
RANGE (NAUT MI)
1200 GMT
18 16 14 12 10 9 8
500 600 800 1000 1200 1400 1600 1800 2000 2200
RANGE (NAUT MI)

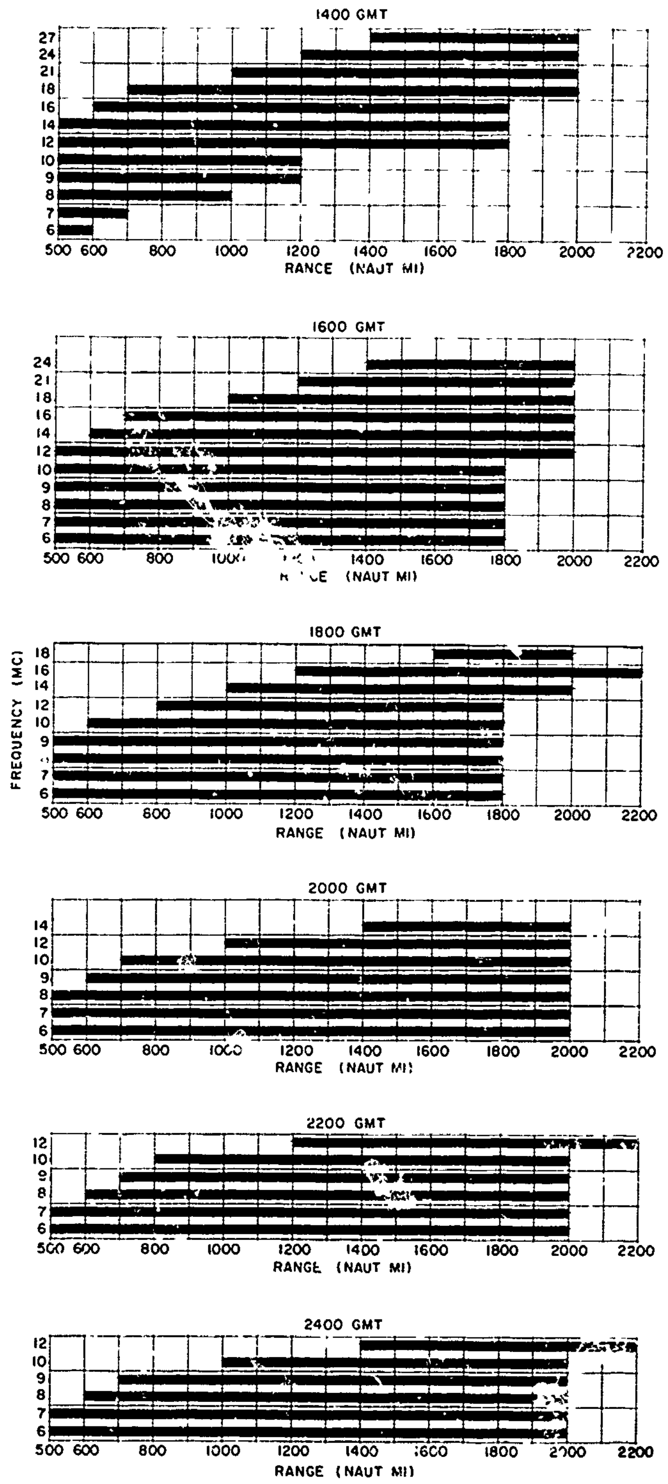
SSN-100 June


1400 GMT
1600 GMT
1800 GMT
2000 GMT
2200 GMT
2400 GMT
FREQUENCY (MC)
RANGE (NAUT MI)
500 600 800 1000 1200 1400 1600 1800 2000 2200

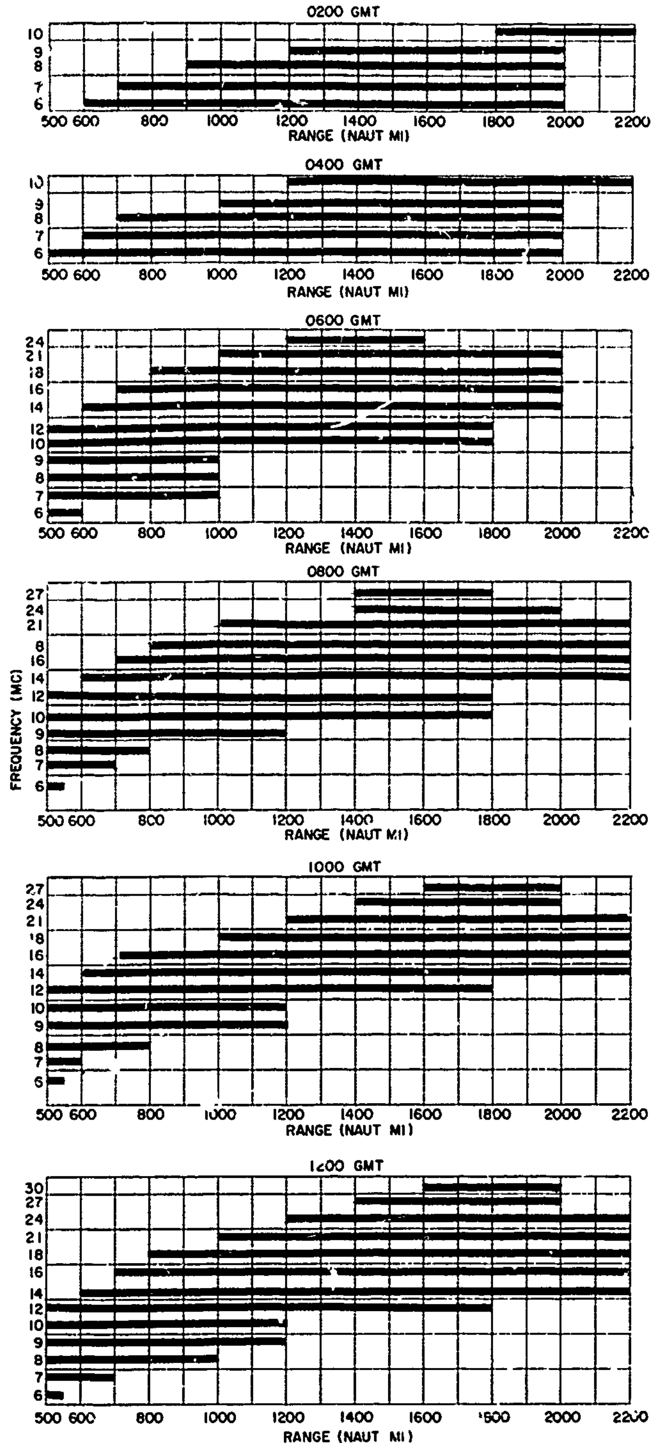
SSN-100 June



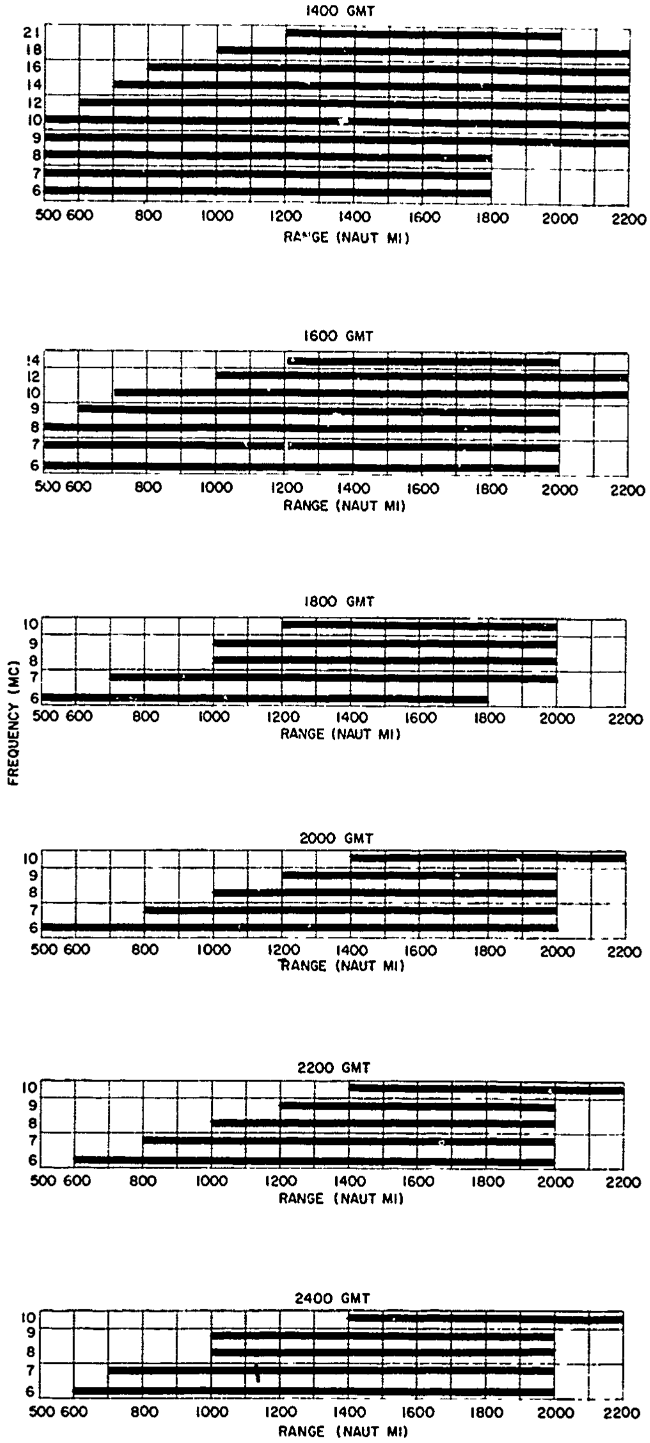
SSN-100 March - September



SSN-100 March - September



SSN-100 December



SSN-100 December

APPENDIX C

USEFUL VERTICAL LAUNCH ANGLES

This appendix gives usefui elevation angles as a function of distance. The plots are arranged according to season and sunspot number. Angles that are set by E-layer propagation are marked E. The useful angles, which are shown as crosshatched areas, have been selected on the basis that the output signal-to-noise ratio is 10 db or better, and angles for paths with probabilities less than 10 percent have not been included. These angle requirements should be considered as made up from averages for a concentrically uniform ion distribution. Thus for any one ray trace no tilt effects have been taken into account, and the actual range of useful angles may be wider than is indicated.

The useful angle spread indicated runs from 0 to 38 degrees. From this form of presentation, the percent time of effective operation furnished by various angles is not specifically available. However, the analysis method described can be used to make such a study, and this is one of the values of the method. To restate, the effectiveness of various vertical angle coverages can be well displayed in a relative manner. One example is given in Appendix D, Fig. D3, reproduced here for convenience.

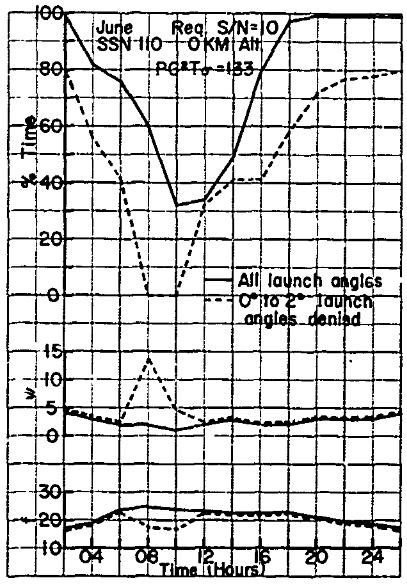
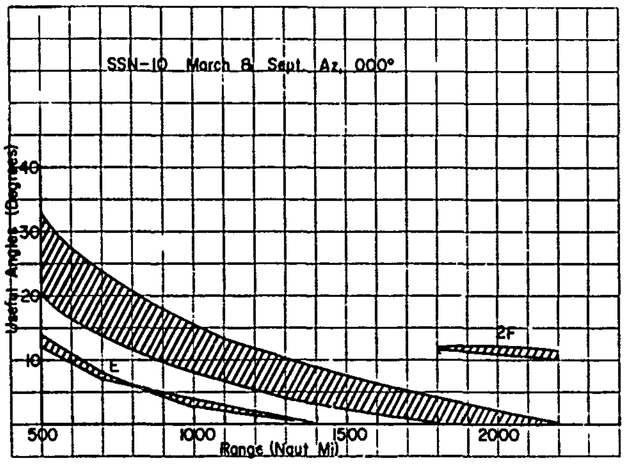
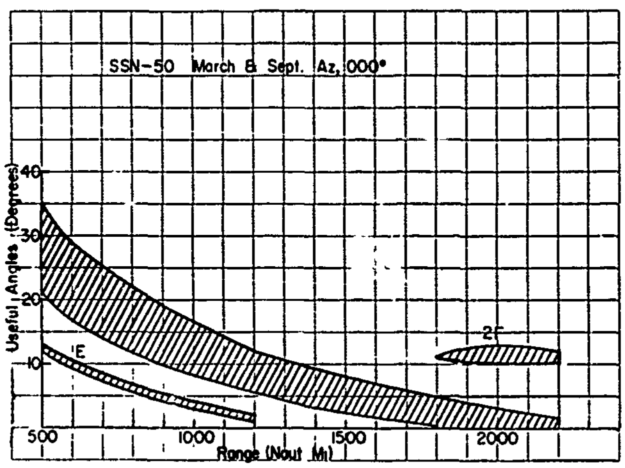
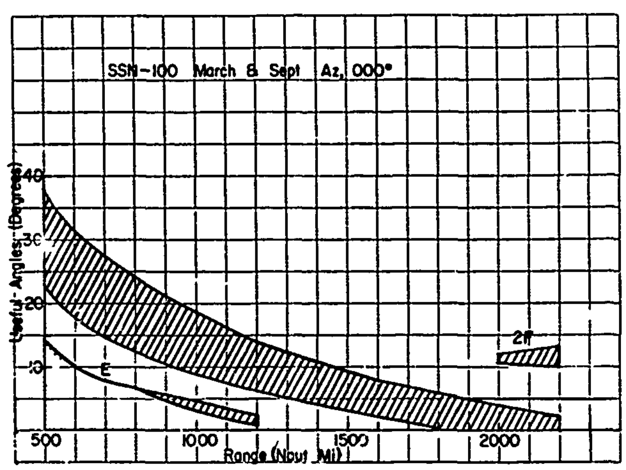
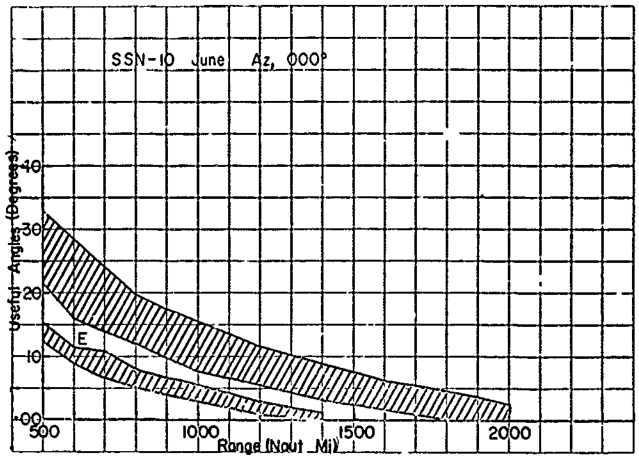


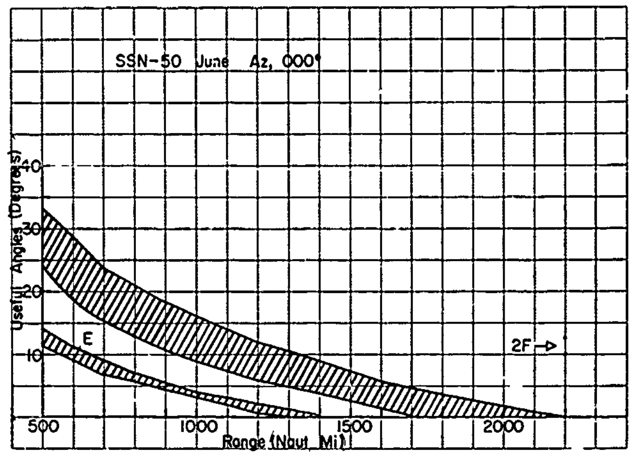
Figure C1

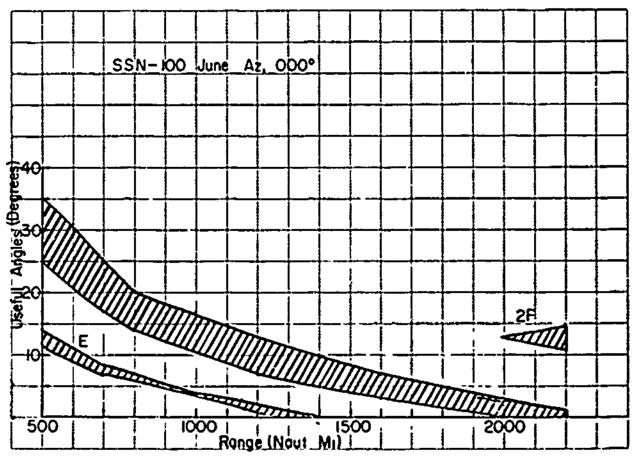

SSN-10 March & Sept. Az, 000°
Useful Angles (Degrees)
40
30
20
10
2F
E
500
1000
1500
2000
Range (Naut Mi)

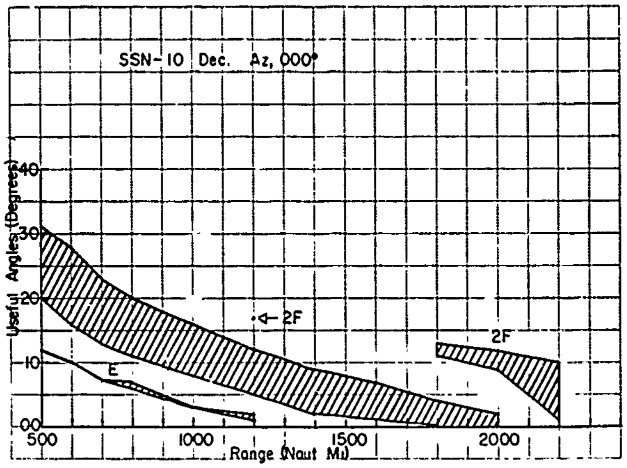

SSN-50 March & Sept. Az, 000°
Useful Angles (Degrees)
40
30
20
10
2F
E
500
1000
1500
2000
Range (Naut Mi)

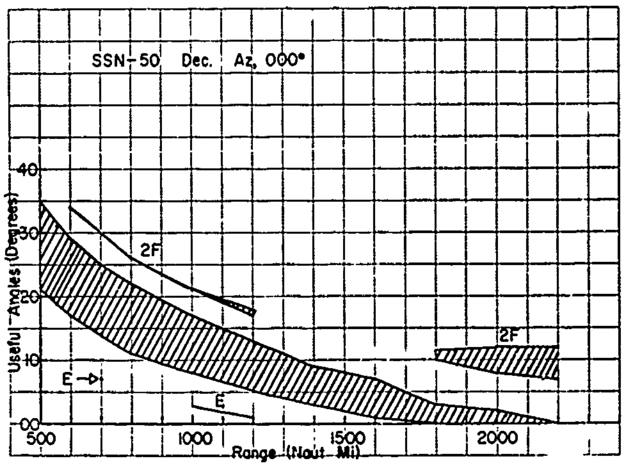

SSN-100 March & Sept Az, 000°
Useful Angles (Degrees)
40
30
20
10
2F
E
500
1000
1500
2000
Range (Naut Mi)

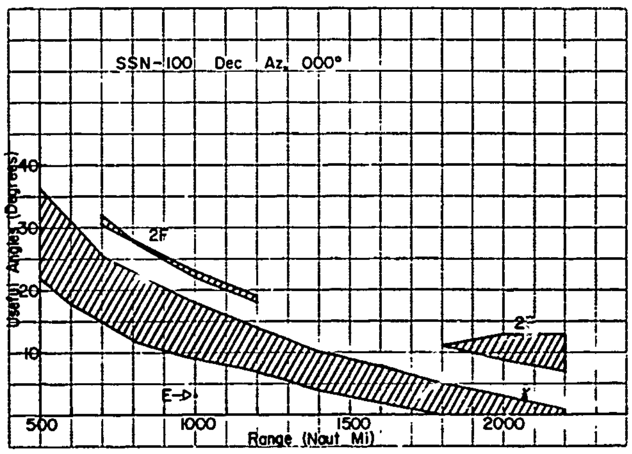

SSN-10 June Az, 000°
Useful Angles (Degrees)
40
30
20
10
00
E
500
1000
1500
2000
Range (Naut Mi)


SSN-50 June Az, 000°
Useful Angles (Degrees)
40
30
20
10
E
2F
500
1000
1500
2000
Range (Naut Mi)


SSN-100 June Az, 000°
Useful Angles (Degrees)
40
30
20
10
E
2F
500
1000
1500
2000
Range (Naut Mi)


SSN-10 Dec. Az, 000°
Useful Angles (Degrees)
40
30
20
10
00
2F
E
500
1000
1500
2000
Range (Naut Mi)


SSN-50 Dec. Az, 000°
Useful Angles (Degrees)
40
30
20
10
00
2F
E
500
1000
1500
2000
Range (Naut Mi)


SSN-100 Dec Az, 000°
Useful Angles (Degrees)
40
30
20
10
2F
E
500
1000
1500
2000
Range (Naut Mi)

APPENDIX D

PERFORMANCE WITH TARGET AT ALTITUDE

The report study has been for targets near the earth surface, and the one-hop mode was found dominant in providing the best coverage. The report results can be considered applicable to targets at any altitude below the refracting height, but, with a reduction in range if only one refraction is permitted. Radar performance for targets at altitude is of interest for the longer ranges, and a separate study can illustrate expected performance. This study was made for a radar sited in the same general geographic location as the one in the main body of this report, but looking north-east. Performance has been examined at near extreme $1F_2$ range (between 1900 and 2000 naut mi) and a SSN of 110. Figure D1 is a simple diagram of the F_2 modes examined for the performance study; a similar set for the E layer was also used. There was one important difference in this study from that of the main report; that is, vertical launch angles below two degrees were not permitted, and there was a minor difference in that the frequency complement was less.

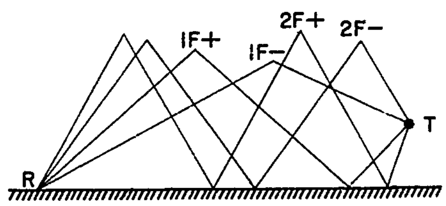
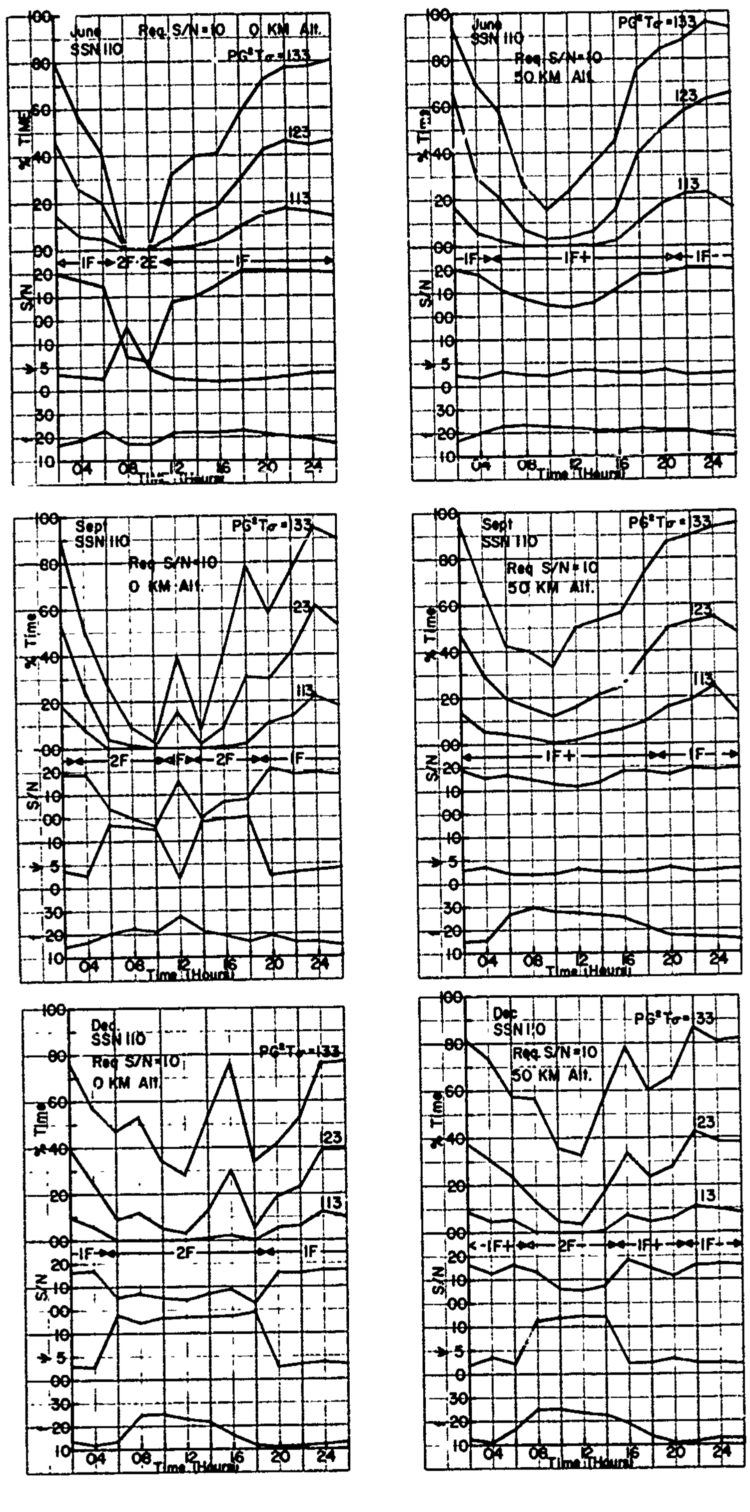


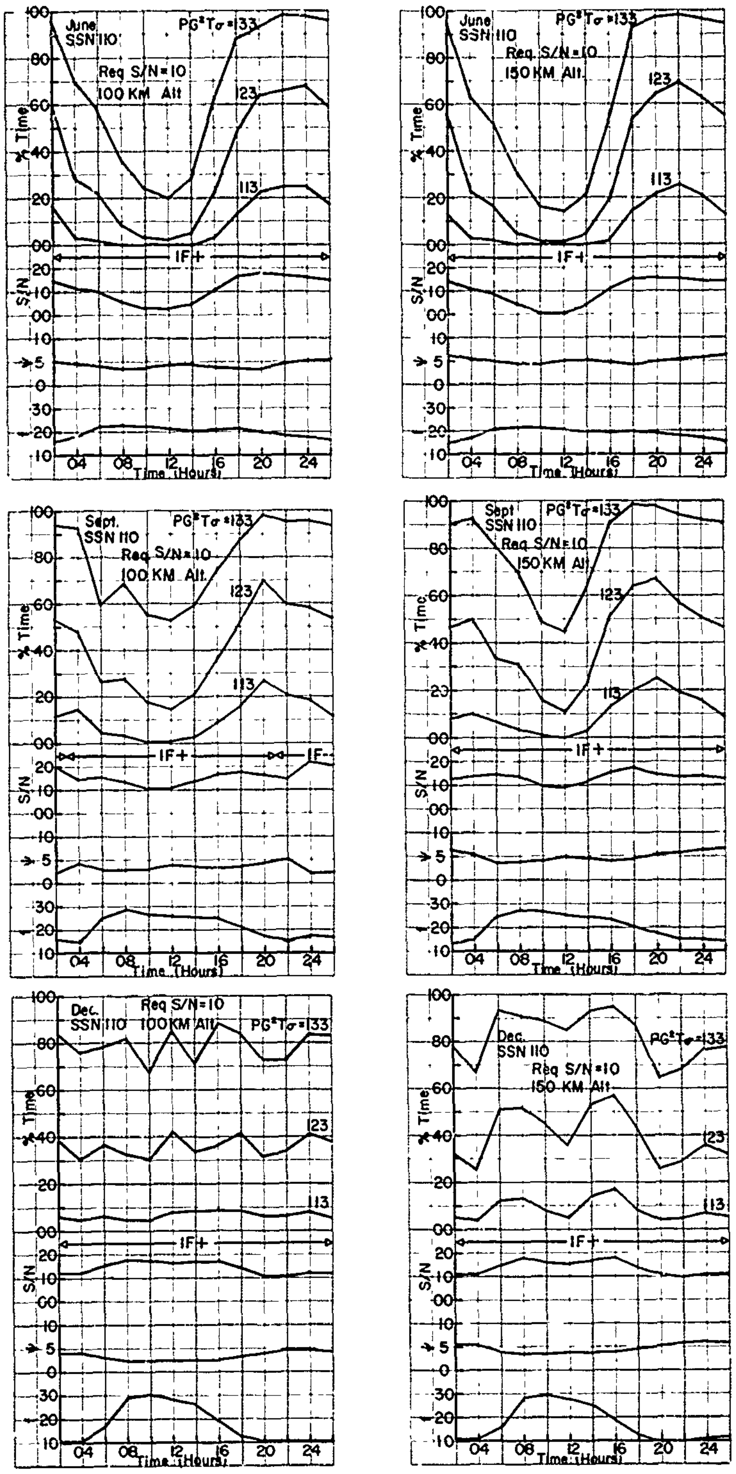
Fig. D1 - The transmission modes considered for targets at altitudes greater than zero sketched for F-layer reflection

The results are presented in the form of percent time for effective operation (T. Rel) for three values of $PG^2T\sigma$ and a required S/N = 10 db, median signal to median noise per cps ratio for $PG^2T\sigma = 133$, vertical launch angle, and operating frequency (median MUF) versus hour of day. The mode providing the better S/N is indicated as 1F-, 1F+, etc. The absorbing region was taken as slightly below 100 km. Figure D2 gives the results of this study.

These figures show that percent time coverage for targets at altitude is superior to that at ground level with the best performance at 100 km. Some caution must be exercised in comparing this study with that in the main report body because of the elimination of launch angles below two degrees. Figure D3 gives a comparison between performance against a low level target with and without the first two degrees of vertical launch angle. Thus when low launch angles are permitted, operation against high-altitude targets may not be better than for those near the surface, but it is probably comparable.

Table D1 gives a daily average summary. Here it may be well to stress that successful radar use implies good knowledge of existing propagation conditions and intelligent selection of radar operating technique. Figure D4 gives median MUF frequencies and vertical launch angles required for all altitudes examined. It can be seen that if a missile is to be tracked from near the ground up to 150 km, more than one operating frequency and one launch angle may be required. If the requirement for detection below 50 km is relaxed, good operation probably can be achieved on one frequency.


June
SSN 110
Req. S/N = 10
0 KM Alt.
50 KM Alt.
Sept
Dec
% Time
S/N
Time (Hours)
123
113
1F
2F
1F+


June
SSN 110
PG²Tσ = 133
Req S/N = 10
100 KM Alt
June
SSN 110
PG²Tσ = 133
Req S/N = 10
150 KM Alt
Sept.
SSN 110
PG²Tσ = 133
Req S/N = 10
100 KM Alt
Sept
SSN 110
PG²Tσ = 133
Req S/N = 10
150 KM Alt
Dec.
SSN 110
Req S/N = 10
100 KM Alt
PG²Tσ = 133
Dec.
SSN 110
PG²Tσ = 133
Req S/N = 10
150 KM Alt
123
113
IF+
IF-
% Time
S/N
Time (Hours)

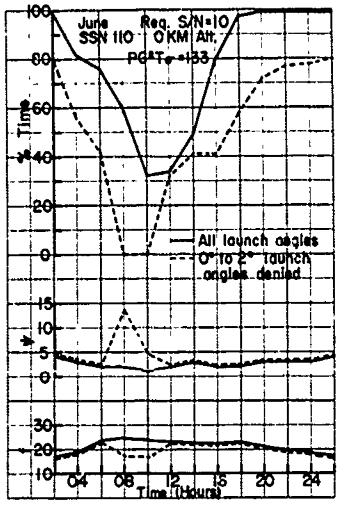


Fig. D3 - A comparison between the cases in which (a) all launch angles are permitted, and (b) the first two degrees are denied. Note that the median MUF differs for only two hours, 0800 and 1000, for the two cases, but that there is a very appreciable difference in effective operating time over the day. This result is because the use of launch angles below two degrees adds considerably to the total reliability.

Table D1
Effective Operating Time, Given by Daily Average

$PG^2T\sigma$ = 133			
Target Alt.	June	Sept.	Dec.
0 km	48 (76)*	48	52
50 km	59	65	64
100 km	64	78	79
150 km	61	80	82
$PG^2T\sigma$ = 113			
0 km	7	6	4
50 km	8	9	5
100 km	9	11	7
150 km	9	10	9

*All launch angles permitted.

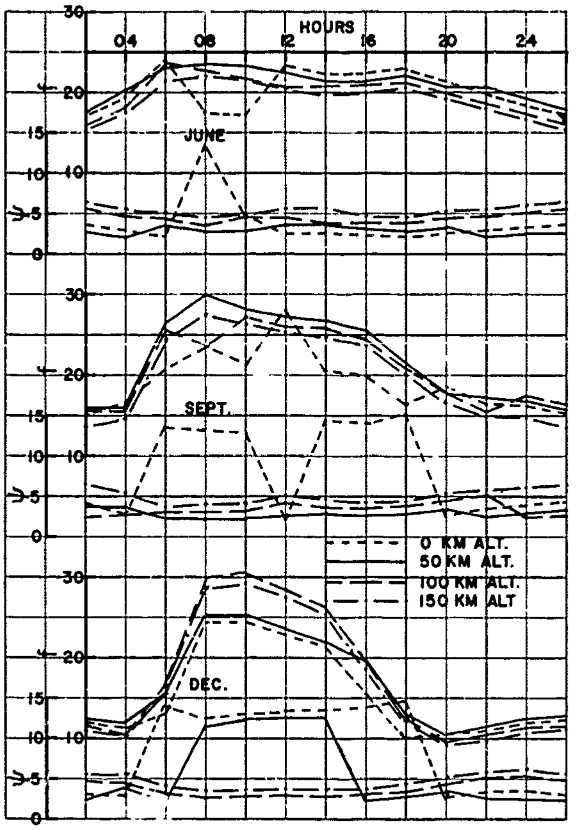


Fig. D4 - The median MUF and its launch angle, shown as combined plots for the altitudes considered

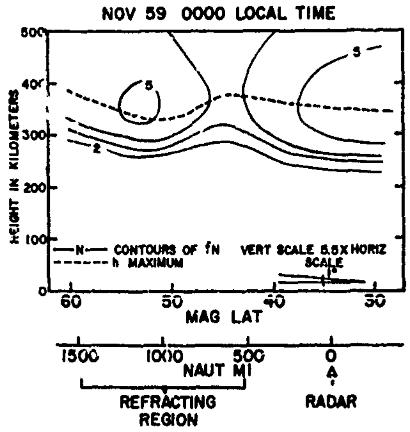
APPENDIX E

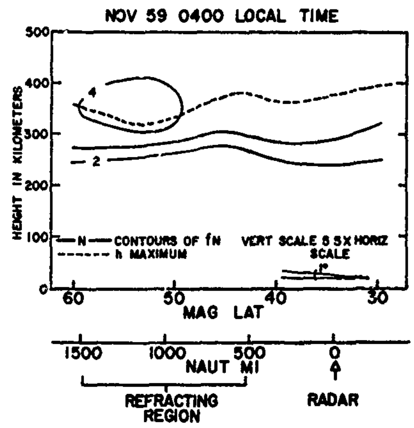
IONOSPHERIC TILT EFFECTS

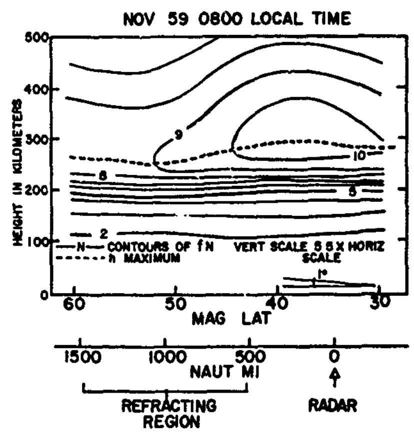
The term "ionospheric tilt" will be used to describe the condition of nonconcentric contours of electron density. Effects of a tilt are that (a) the launch angle and the angle of arrival of a ray are not equal, and (b) the maximum great-circle ground distance that can be spanned with one refraction is reduced. Some large-scale tilts can be identified by backscatter sounder observations of an abnormally long distance to the earliest earth echo (when this distance is well over 2000 naut mi), when the explanation is that two ionospheric refractions occur between the earth launch and subsequent earth arrival. Such large-scale tilt effects are frequently associated with sunrise and sunset on east-west paths, and transequatorial paths in the evening. In addition to these diurnal large-scale bulges in the ionosphere, there exists, both in time and area, finer-scale roughness or eccentricity in ionization density. In the computation method used for this report, the ionosphere was considered to be spherically stratified for each ray trace. This assumption is not realistic, however, and the numerical maps used in computation have some of the information which could permit tilts to be treated on a monthly median basis. However, experience indicates that the true tilt at any one instant bears little relation to the monthly median tilt for north-south paths similar to those examined in the report. It may be instructive to show what might be expected in the way of monthly median tilts, and then to examine some daily and hourly tilt variations. The aim will be to show how the radar performance and requirements may be affected by tilts. The principal requirement that may be affected is of vertical plane launch angle. For example, if there always existed a continuous going-away upward tilt relative to the radar, launch angles below a minimum defined by the tilt would never return to the earth and would not be useful for near-earth targets. This rather ridiculous example represents the case in which small launch angles are useless. Of course in a practical vein, launch angles right down to the horizon will always provide better quality coverage at distance than any abridgment of low vertical angles; tilts can cause regions where poorer two-hop coverage must be accepted, but may also provide good very-long-range performance where a successive up-and-down tilt is used with no intervening ground reflection or passage through the lossy D layer.

The best monthly median profile data that have been found are due to Wright, et al.* Figure E1 has been drawn from Wright; these curves show plasma frequency contours and height of maximum ionization versus geomagnetic latitude for the month of November 1959 at six-hour intervals. These data were taken near the western 75th meridian, but are probably reasonable examples of what might be expected at corresponding geomagnetic latitudes in the eastern hemisphere. Although these profiles change from month to month and year to year, the set shown represents a fair example. A mileage scale has been drawn on each chart, with the radar location and the refracting region indicated for one-hop ranges. Inspection of these figures will show that during a monthly median day, tilts will vary in sense depending on time. Further, it is evident that the degree and direction of tilt can be a function of both frequency and range. This type of data clearly does not support the thesis that low-angle radiation is useless, but it does suggest that the launch-angle requirements given in this report may not be as divergent as they should be.

*J. W. Wright, L. R. Wescott, and D. J. Brown, "Mean Electron Density Variations of the Quiet Ionosphere," U.S. Dept. of Commerce, NBS Technical Notes 40-1 through 40-13 (Unclassified), 1960-1963.


NOV 59 0000 LOCAL TIME
HEIGHT IN KILOMETERS
500
400
300
200
100
0
5
2
—N— CONTOURS OF fN
------ h MAXIMUM
VERT SCALE 5.5X HORIZ SCALE
60
50
40
30
MAG LAT
1500
1000
500
0
NAUT MI
REFRACTING REGION
RADAR


NOV 59 0400 LOCAL TIME
HEIGHT IN KILOMETERS
500
400
300
200
100
0
4
2
—N— CONTOURS OF fN
------ h MAXIMUM
VERT SCALE 5.5X HORIZ SCALE
60
50
40
30
MAG LAT
1500
1000
500
0
NAUT MI
REFRACTING REGION
RADAR


NOV 59 0800 LOCAL TIME
HEIGHT IN KILOMETERS
500
400
300
200
100
0
9
10
6
8
2
—N— CONTOURS OF fN
------ h MAXIMUM
VERT SCALE 5.5X HORIZ SCALE
60
50
40
30
MAG LAT
1500
1000
500
0
NAUT MI
REFRACTING REGION
RADAR

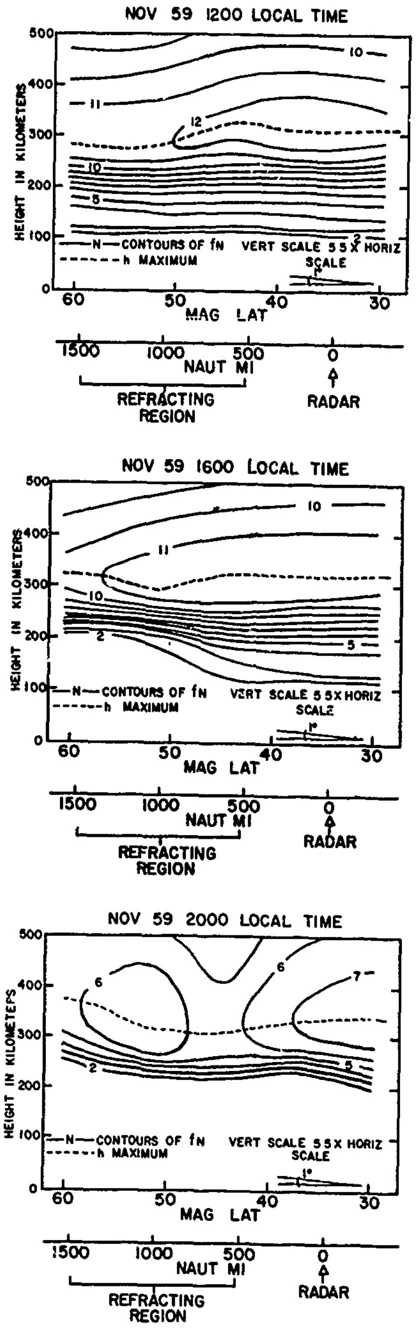


Fig. E-1 - Contours of plasma, fn, and height of maximum ionization versus magnetic latitude. A mileage scale is included with a radar location and the refracting region is indicated for long distance, one hop path.

A short study of the variability of tilts has been made. The experimental data used have been the vertical ionospheric soundings taken at Wallops Island and Cape Kennedy; these stations are separated by about 600 naut mi, which is a little longer than the distance a long-range propagation path would spend in the refracting region; they approximately bracket the right geomagnetic latitudes for the radar treated in this report. Vertical soundings for June 1965 at noon and midnight were used to determine (a) daily variation in tilt angle, (b) launch angle for grazing incidence (i.e., for maximum one-hop range), and (c) path length. The computation was performed for both a frequency near the MUF and for one well below the MUF, using transmission curves. It was necessary to make some assumption and the one made was that the transition between the ionospheric conditions at the two sounding stations was linear; that is, for one virtual height, h'_w, at Wallops, and a second virtual height, h'_k, at Kennedy, intermediate virtual heights vary linearly with distance from h'_w to h'_k. The reflection point of the propagation path has been always taken as midway between Wallops Island and Cape Kennedy, with a virtual height of $(h'_w + h'_k)/2$, and the tilt is defined by the difference between the two heights. This is a quite simplified approach, with several questionable assumptions. The argument advanced is that even with the gross assumptions, the results obtained will be indicative of the variations in sense to be expected; it is felt that the derived tilts may be more extreme in magnitude than actual tilts. Figure E2 is an exaggerated sketch to illustrate tilt effects. The solid line, starting at T, reflecting from the ionosphere, and returning to the earth at a distance R, represents the no-tilt case. Examples for tilt in both directions of the same magnitude are shown by dashed lines. Note that the range, R', is the same for both cases, and that a tilt in either direction results in a reduction ΔR in maximum one-hop propagation distance. The difference between the two cases is that for a down tilt a grazing launch angle is required to achieve maximum range, whereas for an up tilt a launch angle somewhat higher than the tilt angle provides maximum range; in this latter case, smaller launch angles provide rays that do not return to the earth after reflection.

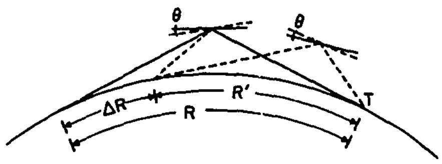


Fig. E2 - Tilt geometry

Figure E3 gives data for noon in June 1965; tilt angle (in degrees), launch angle (in degrees), and one-reflection maximum range (in kilometers) are shown for the days in the month for which good sounding traces were available. The average tilt for both the frequency near the MUF ($\bar{x}$) and the frequency well below the MUF ($\bar{o}$) is upwards in a southerly direction. This appendix treats the effects of an average upward tilt on launch angle requirements, and so the radar will be considered as placed looking south. The average tilt indicated for both frequencies in Fig. E3 is about one degree, and when this case obtains, launch angles below about 8 degrees do not permit rays to return to the earth. Examination of Fig. E3 shows that:

1. Of the 22-day sample at the MUF:

   a. Nine days have an up tilt
   b. Three days have no tilt
   c. Ten days have a down tilt
   d. On 13 days a zero degree launch angle provides maximum range for one hop
   e. The largest launch angle for grazing incidence at the other end is 19-1/2 degrees
   f. Propagation distances are the greatest on no-tilt days and shortest on max-tilt days

g. The predicted propagation distance (x_p) lies between the average distance ($\bar{x}$) using tilts and the no-tilt average distance ($\bar{x}_{nt}$)

2. Of the 23-day sample below the MUF:

a. Ten days have an up tilt
b. Nine days have no tilt
c. Four days have a down tilt
d. On 13 days a zero degree launch angle is required to get maximum one-hop range
e. The largest launch angle is 18 degrees
f. Propagation distances are greatest on no-tilt days and shortest on max-tilt days
g. The predicted propagation distance lies below that for no tilt and that for an average tilt.

One possible interpretation of these data is that contours of constant electron density are more nearly spherical at lower altitudes than at higher altitudes. On the average a greater propagation distance can be achieved by operating at a frequency lower than the MUF, because tilts at these frequencies are less extreme.

The situation at midnight is illustrated in Fig. E4. The average tilt is up to the north at the MUF and slightly down to the north at well below the MUF. The radar will be considered as looking north.

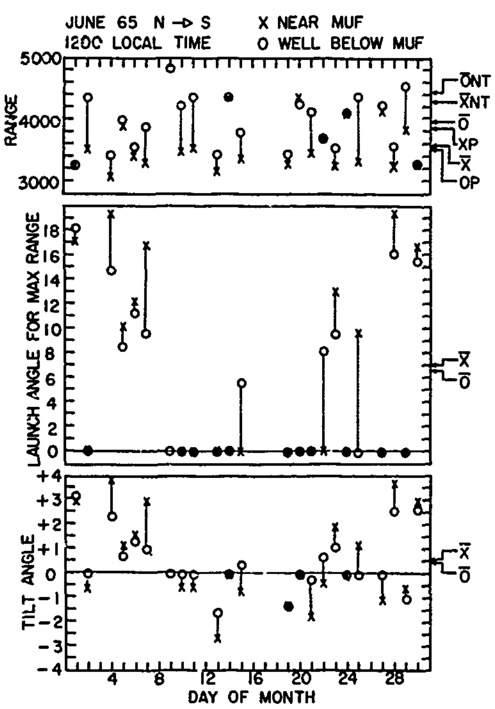


Fig. E3 - Tilt angle in degrees, launch angle in degrees for maximum one-hop range, and maximum range in kilometers given by day of the month at noon

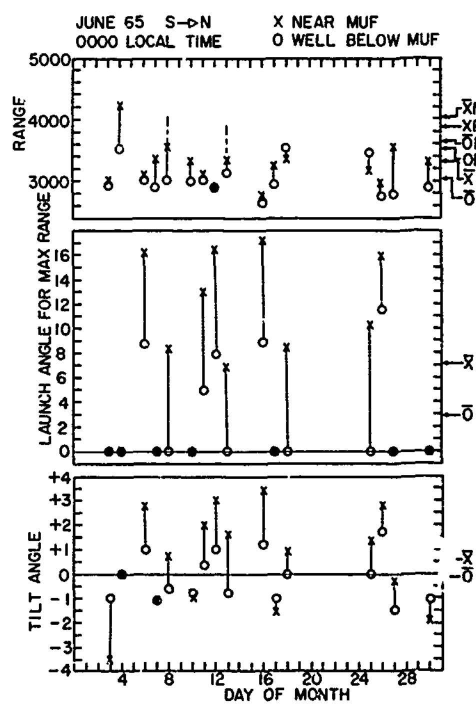


Fig. E4 - Tilt angle in degrees, launch angle in degrees for maximum one-hop range, and maximum range in kilometers given by day of the month at midnight

1. Of the 16-day sample taken at the MUF:

   a. Nine days have an up tilt
   b. One day has no tilt
   c. Five days have a down tilt
   d. On seven days a zero launch angle gives maximum coverage
   e. The largest launch angle for grazing at the other end is 17-1/2 degrees
   f. The propagation distance is greatest on the no-tilt day
   g. The predicted propagation distance lies between those predicted for the tilt and no-tilt cases.

2. Of the 16-day sample well below the MUF:

   a. Five days have an up tilt
   b. Three days have no tilt
   c. Eight days have a down tilt
   d. On eleven days a zero launch angle gives maximum coverage
   e. The largest launch angle required for grazing at maximum range is 12 degrees
   f. Propagation distances are greatest on the no-tilt days and shortest on the max-tilt day
   g. The predicted propagation distance lies between those predicted in the no-tilt and tilt cases.

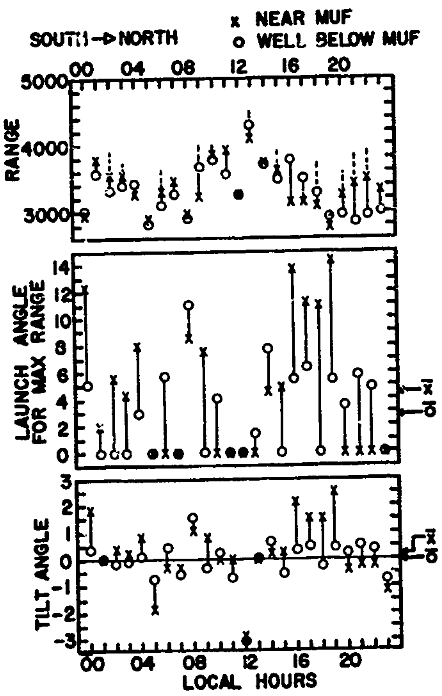


Fig. E5 - Tilt angle in degrees, launch angle in degrees, and maximum range for maximum one-hop distance given by hour of the first day of the month

In general the MUF provides longer range coverage than frequencies below the MUF. This suggests a more parallel structure of the lines of constant electron density when compared with the midday case.

Examination of the data for one month at noon and midnight shows how the day-by-day experience may compare with the monthly median; however, the variability exhibited has been considerable, and it seemed useful to display variations in a typical day. Figure E5 gives the results from studying hourly ionograms on the first day of the month. The scatter in tilt and required launch angle by hour is somewhat similar to that shown by day at the same hour. Some indications of cyclic behavior can be seen, and if the hourly sampling rate is adequate (very questionable):

(a) Well below the MUF, the period for tilt oscillations from plus to minus is about two hours

(b) Near the MUF, the period for tilt up and down cycles seems to be between four and eight hours.

At either near the MUF or well below, the tilt can change from up to down in an hour, or possibly less time. The vertical launch angle that provides maximum distance one-hop coverage can change ten degrees in an hour's time.

This rather limited and simple study does little to show how tilts should be handled in propagation predictions, but it does provide some insight into tilt behavior, and some definite guides to radar design are evident. In particular, the radar with vertical antenna pattern directivity must be steered in a manner adapted to the conditions of the moment, which implies that the existing condition must be recognized. Maximizing one-hop distance is desirable because of the 10 to 20 db inferiority of the two-hop mode, plus the accompanying poorer measurement of target range, speed, and azimuth. This study shows the need for low launch angles to obtain high reliability and suggests that launch-angle requirements are variable over a wider span than indicated in the main report and Appendix C. One further matter is of interest, namely that the predicted one-hop maximum distances of this report are certainly a little long. The most important consequence of this tilt exercise is that it serves to emphasize that the radar needs to be quite flexible, that a continuous assay of the propagation path is required, and that operation must be adjusted to the conditions of the moment.

SECRET

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author) Naval Research Laboratory Washington, D.C. 20390	2a. REPORT SECURITY CLASSIFICATION Secret 2b. GROUP 3

3 REPORT TITLE

HIGH-FREQUENCY SKY-WAVE RADAR PERFORMANCE [UNCLASSIFIED TITLE]

4 DESCRIPTIVE NOTES (Type of report and inclusive dates)

An interim report on the problem.

5 AUTHOR(S) (First name, middle initial, last name)

James M. Headrick, Emerson N. Zettle, and Donald L. Lucas

6. REPORT DATE	7a. TOTAL NO OF PAGES	7b NO. OF REFS
June 1, 1967	153	13

8a CONTRACT OR GRANT NO NRL Problem R02-42 b. PROJECT NO. USAF MIPR (30-602)64-3412 c. March 26, 1964 d.	9a ORIGINATOR'S REPORT NUMBER(S) NRL Report 6568 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

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11. SUPPLEMENTARY NOTES	12 SPONSORING MILITARY ACTIVITY Department of the Air Force (Rome Air Development Center) Rome, New York.

13 ABSTRACT [Secret]

The expected performance of high-frequency radar has been examined as a function of sunspot cycle, season, and time of day, using recent ITSA techniques. The method of performance assay provides a good basis for both radar design and comparison. A particular set of radar parameters was chosen:

$$PG^2T\sigma = 137 \text{ db}$$

where

P = average power above a watt

G = antenna gain above an isotropic radiator in free space

T = predetection integration time over a second

σ = target radar area over a square meter,

and a 10-db postintegration signal-to-noise ratio is required. A 5-to-1 frequency band permits effective operation at distances from 500 to 1500 naut mi 95 percent of the time, to 1900 naut mi 80 percent of the time, and to 2000 naut mi 60 percent of the time. The sporadic E effects have been ignored, which makes long-range

(over)

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
High-frequency radar Radar performance Skywave propagation Sunspot cycle Season Time of day Ionosphere (Unclassified list)						

coverages optimistic. The better coverage long-range limit is generally set by the maximum one-hop distance. Vertical launch angles between 0 and 38 degrees are useful. Performance improvement possibilities have been examined; it is estimated that 20 to 40 db over the postulated 137 db could be achieved.

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Naval Research Laboratory. Report 6568 [SECRET-Gp-3]. HIGH-FREQUENCY SKY-WAVE RADAR PERFORMANCE, by J.M. Headrick, E.N. Zettle, and D.L. Lucas. 153 pp. and figs., June 1, 1967.

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MEMORANDUM

20 February 1997

Subj: Document Declassification

Ref: (1) Code 5309 Memorandum of 29 Jan. 1997
(2) Distribution Statements for Technical Publications
NRL/PU/5230-95-293

Encl: (a) Code 5309 Memorandum of 29 Jan. 1997
(b) List of old Code 5320 Reports
(c) List of old Code 5320 Memorandum Reports

1. In Enclosure (a) it was recommended that the following reports be declassified, four reports have been added to the original list:

Formal: 5589, 5811, **5824**, 5825, 5849, 5862, 5875, 5881, 5903, 5962, 6015, 6079, 6148, 6198, 6272, 6371, 6476, 6479, 6485, 6507, 6508, 6568, 6590, 6611, 6731, 6866, 7044, 7051, 7059, 7350, 7428, 7500, 7638, 7655. Add **7684**, **7692**.

Memo: 1251, 1287, 1316, **1422**, [redacted], 1500, 1527, 1537, 1540, 1567, 1637, **1647**, **1727**, **1758**, 1787, 1789, 1790, 1811, 1817, 1823, **1885**, 1939, **1981**, 2135, 2624, 2701, 2645, 2721, 2722, 2723, 2766. Add **2265**, **2715**.

The recommended distribution statement for the these reports is: **Approved for public release; distribution is unlimited.**

2. The above reports are included in the listings of enclosures (b) and (c) and were selected because of familiarity with the contents. The rest of these documents very likely should receive the same treatment.

JM Headrick
J. M. Headrick
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